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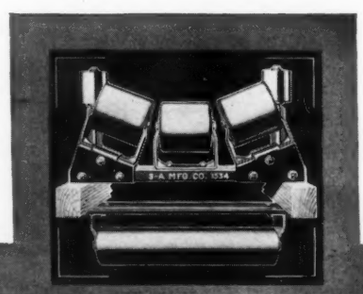

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Persistence of Tertiary Veins in Depth

WHEN WE TALK about veins persisting in depth, or dying out, it is first of all necessary to specify what kind of veins. There are veins and veins. And the known laws vary accordingly.

Take, as one type, the shallow-formed veins, which have formed in or near volcanic rocks of Tertiary age. These have been sometimes called the bonanza type. They were formed in the Tertiary, in a belt around the rim of the Pacific Ocean, and to some extent elsewhere. In North America they form a prominent type of vein in all the regions from the Rocky Mountains to the Pacific—the Cordilleran belt.

The ores of these veins never had great vertical range of ore-deposition; this was due to the conditions of formation. The greatest demonstrated vertical range which we know for ore deposits of this type is at Guanajuato, in Mexico, where, at the Valenciana mine, from top to bottom, the extent was around three thousand feet. At Guanajuato they had the top of the orebody as well as the bottom; so they had the whole vertical range. Other similar veins, however, are cut by erosion at various planes—near the top, around the center, or near the bottom. So your typical Tertiary bonanza-type vein (predominantly gold-silver bearing) may go down five hundred, a thousand, fifteen hundred, feet. You are very lucky if it goes down two thousand (from top to bottom of orebody); and it is probable, from the above observations, that around three thousand feet is the greatest depth you can hope for—and ten to one your hopes will be blasted.

Where these veins are bottomed—and our Western country is very full of these veins which have been bottomed—there is no more. Useless to theorize about "barren zones," "secondary enrichment," and other ignorant, pseudo-scientific claptrap, and spend good money in deep sinking. It has been tried, and never succeeded. Theoretically, also, the chances are all against success.

These observations apply only to the type of veins described. We may take up the question of other types later. The extreme vertical limit of some types has never yet been reached.

The Tractor in Mine Operation

THE INTRODUCTION of underground mining machinery marked the beginning of an epoch which may well be regarded as an important one in the annals of mining. The compressed-air drill, the various types of haulage equipment, the loading machine, the small-type air hoist, all registered advance in underground work and have aided in keeping costs at figures that have permitted a margin of profit despite increasing wages and other advancing expenses. The trend toward mechanicalization of operations has been noticeable not only in underground work; in fact, considerable advances have been made in surface-machinery design, the greater part of which has a direct application to underground operation, although situated "on top." Here, however, the trend has been toward larger capacity machines, such as hoists and compressors, rather than toward perfecting equipment for a diversity of purposes.

With the advent of the automobile, and later on the automobile truck, many of the vexatious problems concerning transportation were solved, but there remained a demand for a machine which would successfully, and at a moderate cost, perform certain functions that were done either by large machinery, manual methods, or not at all. This was particularly true, and still is, at some of the smaller mines and those to which shipment is expensive and difficult. This demand is met, to some degree at least, by the small-type tractor, which seems to combine portability, power, low cost, and simple operation. The capacities of the different makes vary, but it may be said that 20 hp. is about an average. Fuel consumption is small, and other considerations make its use most advantageous to the mine operator.

The application of the gasoline-driven tractor to uses other than those for which it was primarily designed is proving to be a boon that should not be overlooked. Not only is such a design suitable for all sorts of transit problems about the mine, mill, and smelter, but with slight modifications it can be transformed into a complete power unit applicable to such operations as the hoisting and loading of materials, the operating of certain types of drills, and serving as a driving unit for portable air compressors.

Cyanidation and Seaweed

INTERESTING RESEARCHES have been made lately at the experimental plant of the Department of Agriculture at Summerland, Cal., on the utilization for various industrial purposes of what is termed kelpchar. The harvesting of seaweed and the burning or other treatment of the kelp assumed large proportions in California during the war, the monthly output of weed handled during 1917 amounting to about 24,000 tons. A number of products were made; these included acetone, used in the manufacture of munitions. Attention is now being paid to the utilization of the char as a bleaching and purifying agent.

The use of lump charcoal as a precipitant of gold in aurocyanide solution is of historic interest only. Finely powdered, however, it is remarkably efficient for the purpose. The decolorizing and purifying of liquids by such material is essentially a physical action, depending on adsorption. It is not strange, therefore, that a recognition of the bleaching properties of kelpchar should have led to an inquiry as to its utilization as a

precipitant of gold in solutions resulting from the cyanidation of ores. Tests have been made by Dr. W. J. Sharwood, of the Homestake company, who has demonstrated that kelpchar is an efficient substitute for the metallic precipitant that is ordinarily used in metallurgical plants.

Not long ago a patent was taken out in England to cover a process whereby it was alleged that the gold in sea water could be recovered by adsorption on colloidal carbon. Dr. Sharwood's tests indicate another link in the chain of investigation by which it may be possible to concentrate the gold in sea water by means of a "precipitant" found in close proximity to the "mine." The problem would seem to lie in the selective adsorption of the gold compound, to the exclusion of the other constituents of sea water; and this is doubtless where any practical application of the idea would fail.

Experimentation of this kind may appear to have no immediate commercial application; but every step in progress toward a comprehensive knowledge of all such reactions will help to formulate a satisfactory explanation of much that is now obscure in many phases of wet chemico-metallurgical operations. It may, moreover, form the basis of further research that may point a way to more economical and efficient treatment of low-grade ores.

Revival of the Slate Industry

THE USE OF SLATE for covering places of human habitation probably dates back to the prehistoric period when the cave man sought refuge from storms beneath arched piles of slate that had fallen down in precipitous ravines. When man progressed beyond the stage of merely seeking refuge, to that of rudely hewing his home in the face of a cliff, undoubtedly slate still held its own as a roofing material; and possibly it covered the homes of a larger proportion of the human race than it does in the year of grace 1922. However, as the statistics of that period are somewhat less accurate than those of today, it is clearly out of the question to settle the matter conclusively.

Coming down to more modern times, a slate-roofed chapel built in the eighth century at Bradford-on-Avon, Wiltshire, England, affords evidence of the use of this mineral product many centuries ago. Through succeeding years the slate industry has experienced alternate periods of activity and depression. Cheaper and more easily handled, though less-enduring materials, have found public favor; and one after another has fought with slate for supremacy in the roofing industry. The struggle is by no means over; in fact, the competitors in the field are increasing constantly. The extension of the slate industry to include the manufacture of steps, panels, baseboards, and electrical switchboards has alleviated the situation to some extent, but competition in these branches also is remarkably keen.

During the war some activities in the slate industry were seriously curtailed, for structural and roofing slate were classed as non-essential products from a military standpoint. On the other hand, the manufacture of slate switchboards received added impetus, for they were regarded as essential, and were greatly in demand. On the whole, slate recently has experienced a succession of lean years. For roofing it must compete with tile, various composition materials, wood shingles, asbestos shingles, and lately with zinc and copper also. For structural and switchboard purposes, soapstone, marble, and tile are active competitors.

The depressed condition of their industry has lately aroused slate producers to a realization of the great need for united action to obtain the recognition that their product warrants. Two conferences have recently been held, with the result that a National Slate Association has been formally organized. A committee is now preparing bylaws and making plans for future activities.

Heretofore the demand for slate have been governed largely by increases or decreases in the popularity of competing materials, the slate producers having passively accepted whatever came their way. The recently established organization should mark a new era in the slate industry—an era when passivity will give place to aggression. There is now evident in the industry a spirit of unity that heretofore has been sadly lacking, a tendency for everyone to put his shoulder to the wheel in an earnest endeavor to improve the product and broaden the market; there has been an awakening to present-day industrial tendencies and opportunities and a realization of the need for co-operative effort, instead of the unorganized and ineffective policy of every man "going on his own."

Fabricating Copper Articles at the Mine

A CLOSER CO-OPERATION between mining and manufacturing promises to result in the avoidance of so much economic waste that it is interesting to note that experimentation in connection with the direct production of copper sheeting from leach solution is still in progress at one, at least, of the large copper plants in the Southwest. For this purpose a revolving drum is employed, somewhat similar in appearance to an Oliver filter, the bottom of which dips in the high-copper solution from the leaching vats, the level being maintained constant, despite a continuous flow into and out of the trough. Cord is wound spirally on the surface of this drum and spaced about three inches apart. The surface is then coated with a solution of sodium sulphide. Current is then applied from an electrode in the bath and travels through the solution to the surface of the revolving drum, on which copper is deposited. A thin but perfectly smooth sheet of copper is deposited. This is wound off on spools, being washed en route. It is then passed through machines and pressed into shapes, which are afterward soldered together to form radiators for automobiles. A number of other all-copper articles might successfully be made in a similar manner.

Congress and Efficiency

DELAY BY CONGRESS in passing the usual appropriation bills is resulting in a stagnation of the U. S. Geological Survey field program. Parties that should be started for the field at once are marking time, and waiting for the necessary action. For work which has to be done as far off as Alaska, and where the season must be carefully parceled out, this is a serious matter, and results in a great loss of efficiency. It would pay the country if Congress would consider these things more—not only how much money

it allots to this and that, but what result is obtained for each dollar. Instead of this practical interest in efficiency, Congress is considering lengthening the working day for Government bureaus to eight hours. Efficincy is not measured by hours but by results.

Under existing Federal regulations, a Government employee may hire a horse or a "horse and buggy"; but it is not legal to hire an automobile. The regulations have not yet been brought up to the automobile era. General Dawes might well look into some of these stupid obstacles to obtaining adequate returns for expenditures.

The Wrong Word

FOR MANY YEARS Mr. Rickard has been a crusader in the cause of better writing among technical men—primarily among mining engineers. He does not contend that literary elegance should be the goal of every engineer, but he does maintain that the engineer should be as efficient in his writing as he is in his technical work. He argues that the first requisite for effective writing, in fact the prime purpose of technical writing, is to express ideas in a form in which they cannot be misunderstood by the reader. It must be clear to be convincing, and, to be successful, an engineer, like a financier, for example, must be able to convince his clients or his associates.

There is no use denying the fact that technical men have been lax in this respect; at the same time it is pleasant to note a tendency to take greater pains with writing. And when a competent engineer takes pains with anything he is likely to do it well. Mr. Rickard has published two books on technical writing, and he is now preparing a third, which will include several chapters of the earlier work, thoroughly revised, and a number of entirely new ones. Of the latter, one is entitled "The Wrong Word." It will be found in the present issue of the *Journal-Press*. Mr. Rickard does not expect everyone to agree with all of his ideas; in fact, he anticipates disagreement with particular details. He hopes, as he says in the preface of his second book, to cause engineers to "sit up and take notice." He strives to arouse intelligent interest in the proper use of language.

Should an Engineer Advertise?

SHOULD A CONSULTING ENGINEER who desires to sell his experience and services undertake to get in touch with prospective clients by the modern method of publishing advertisements in the press? To this question the answers will be many and various.

On the one side is the conception of engineering as a profession—a fourth profession, added to the ancient aristocratic trio, the doctor, the lawyer, and the minister. Tradition prescribes that these three shall not advertise. The doctor who advertises at once places himself in a definite category in our minds—that of the exploiter and quack. The lawyer does not advertise. For such professional men it is understood that advertising is unethical; and, being so considered, it is unprofitable. We once knew an able lawyer who ruined his career by breaking the bounds of tradition and resorting to advertising in order to extend his practice. A professional man, according to custom, lets his work speak for itself. His first case, if the work is well and skillfully performed, procures a reputation growing by word of mouth, and his clientele gradually spreads. And this is practically the custom among consulting mining engineers.

On the other hand, engineering, as has often been pointed out, is a business as well as a profession. This becomes more decided and evident in the case of engineers who specialize in the designing of industrial plants—paper mills, foundries, textile plants, and the like. Such engineers, in addition to being consulting and constructing engineers, may also undertake the management of business, especially of public utilities like gas and electric operations, and street railways. They are essentially business men; and in business, advertising is the chosen and highly devoloped device for securing business. It is not only customary but ethical; it is practical; it answers the purpose of putting the purchaser of goods or services in direct touch with the seller, in the most businesslike and efficient manner.

At a recent meeting of the American Association of Engineers a successful engineer of the type last described took the ground that "Outworn codes of ethics, timidity, custom, and the popular opinion gradually formed from these seem to have set a limit to those who may advertise. But it is a wholly artificial limit. In discussions with engineers regarding advertising I have found no logical objection to it." And he concludes that "The best test of whether advertising is ethical is the test of its truthfulness. If it states the truth, there is no justifiable objection to it."

This wide divergence of opinion comes largely from the wide spread of the great inclusive group loosely called engineers. Mining engineers, it may be stated in general terms, do not advertise. True, they carry their professional cards in the *Journal-Press*, but that is a sort of directory, a method of letting their friends know their postoffice and cable address, rather than a bid for work. Yet most engineers have a lingering hope that on occasion this custom may bring them practice: at the least they look upon it as a necessary precaution, so that they may not be difficult to find if anybody should want them, and an insurance that a sudden undefined opportunity will not perchance pass them by; therefore, in a refined and gentlemanly sense, such a card is an advertisement. Nay, many complain frankly that these cards are not efficient enough, because they are read by other engineers, and not by the men that hire the engineers. And it is not an unknown experiment, as we recall that a firm of consulting mining engineers inserts a conspicuous card—an advertisement, in short—in a sober and conservative financial paper, one read by that class that owns and controls mines: and such an experiment has been made with no loss of prestige. If the practice has not spread, it is perhaps as much on account of the expense as because of any feeling that a breach of professional ethics had been approached.

We have read an interesting account by a Spanish traveler, of his visit to the great Valenciana mine, in Guanajuanto, a couple of centuries ago. According to custom, he "walked" down into the mine, by the tortuous "camino," but was granted the favor of being hoisted up the great octagonal shaft by one of the mule whims which slowly elevated the ore in rawhides. He was put into a sort of saddle, made by looping the end of the hoisting rope, so that he stuck his legs through loops and held on with his hands; and his guide was similarly provided for, directly above him,

on the same rope. If he let go his hand-hold, his legs would slip out of the loops. The hoisting operation took half an hour or more; and the guide regaled him with conversation on the way up. "The last man whom I escorted," he observed, "let go and fell when we were about half-way up, but *with such discretion* that I did not perceive the occurrence till I had arrived at the surface."

The engineer who desires to extend his practice by advertising will perhaps find no logical obstacle, as was claimed by the speaker quoted above. As a practical matter, traditions and popular opinion are also powerful and tangible factors; and he will find it necessary to proceed with as much discretion as the investigator of mines of whom the Spanish author so quaintly writes. And even in this case, although the tale does not specify, we suspect that the exemplary discretion did not save the discreet one from being badly bumped.

The Tariff on Cyanide

DOWN IN CONGRESS there is much discussion about the tariff on cyanide. The Western Senators are divided on the question; but the two Senators from Nevada, respectively Republican and Democrat, are a unit against the tariff. The supporters of the tariff argue in favor of keeping alive an American industry for national emergencies. But its opponents point out that the American industry is a monopoly, of largely German ownership, and that the same company is agent for the German cyanide industry. Therefore, the Nevada Senators do not believe that the mining industry should have to pay a tax, even though a slight one, on its supplies, but that it should buy as cheaply as possible.

Supporters of free cyanide have been somewhat disappointed at the attitude of the American Mining Congress, which has remained neutral in the matter; possibly, it has been surmised, because it does not want to spoil its unbroken record of being in favor of a tariff on everything; and partly, perhaps, for other reasons. We can see no adequate reason for this tariff.

Assaying Without Chemicals

APPROXIMATE assays of certain substances may be determined without the services of the skilled chemist, without fire or chemicals, without grinding the sample, and in a small fraction of the time ordinarily required. All that is needed is a specific-gravity apparatus, such as the Jolly balance, which permits the determination of the weight of a substance first in air, and secondly when submerged in water.

In a paper presented at the annual convention of the American Society for Steel Treating last fall, Arthur S. Townsend, chief chemist of the Cleveland Twist Drill Co., outlined a method for the determination of tungsten in high-speed steels by their specific gravity which was accurate to within 0.3 per cent of the amount of tungsten present. The method, of course, is valuable only when it is known that the steel *is* a tungsten steel and that the amounts of other constituents except iron show little variation in different samples. That is, the tungsten and iron are the variables, the specific gravity of the former being 18.7 and of the latter, 7.8. Then it is only necessary to make up a table giving actual analyses and corresponding specific gravities for reference purposes.

This method would seem to have application in other fields. Why, for example, would it not be possible to determine the amount of copper in blast-furnace matte by this method? The sample could be taken, the weight in air and water determined, and the result calculated by the use of the slide rule or logarithms in five or ten minutes without any more chemical or arithmetical skill than is possessed by the ordinary shift boss or furnace foreman. Matte varies only in its copper and iron content, and, although the difference between the specific gravities of copper and iron is not great, the results should at the very least be as accurate as is necessary for operating purposes. Lead-containing materials offer even greater opportunities for the use of this method than do copper. Slags, as a rule, do not offer quite the possiblities, but valuable information might be obtained here also, where the charges do not show wide variation in composition. At any rate, it would seem to be worth while to assemble the results of a series of chemical analyses and specific-gravity determinations on daily samples and see if some useful relation cannot be found between the two. Diamond-drill cores, and even samples of mine rock, in which the character of gangue and mineral are constant, might also be roughly assayed by this method.

Wanted, More Information About Mines

STATE MINE INSPECTORS or officials who perform their functions should consider it their duty to publish at regular intervals comprehensive lists of the companies operating or having property within their several states. Many of them do, but in some states they do not. Some of the lists published give little more than the name and address of a company. Others are more informative. The report of the Idaho Inspector of Mines, for instance, is practically a handbook of Idaho mines.

Frequently, though it may seem odd, some one who has been offered the opportunity to invest in mining stock is inquisitive enough to want to know about the property. The number of mining companies, with and without holdings, is legion, and often it is with difficulty that such a desire for knowledge can be satisfied. No one should be better posted than a state inspector on the properties within his state. Not that he should knock or boost, or be expected to pass upon the reliability of a company. This would be unwise. But such facts as the address of a company, the location and description of its property, its officers, capitalization, its history in brief, with other kindred data, could well be published annually.

Recently we sought a list of the mines of Alabama. From Birmingham comes word that an up-to-date list of coal-mining operations exists, but not of ore mines. It seems that the state inspector has not been able to establish his authority over operations of this class, and cannot therefore secure authoritative information regarding them. This is but a case in point. If the inspector can secure the information, the public has a right to know it.

Fraudulent stock promotions are made more difficult the more the public knows of the property concerned. They will not be made impossible, however, by any amount of published information, for the boob will still remain a boob and will never stop to ask. Still the information is desirable, that protection be afforded the public, and as a matter of record.

Alaskan Affairs

By T. A. Rickard

THE Governor of Alaska, Mr. Scott C. Bone, stated recently at Washington that the administration of the Territory is "chaotic" and that "the overshadowing need is a simplified and co-ordinated system". For several months there have been rumors of dissension in the President's cabinet, on account of the proposal to remove the Forestry Service from the Department of Agriculture to that of the Interior. It is well to note that even the supporters of the Secretary of Agriculture concede that the development and progress of Alaska are hindered by a bureaucratic control that not only is scattered among several departments but suffers from the fact that it is exercised at a distance of more than 4000 miles.

Surely something is wrong up North. The population decreased from 64,356 in 1910 to 54,933 in 1920. The white people numbered only 30,000 in 1920 and yet they produced and shipped minerals, fish, and furs worth $69,000,000 in that year. Today the whites do not exceed 20,000. The area of Alaska—586,000 square miles—is equal to the combined areas of Minnesota, Wisconsin, Iowa, Illinois, Missouri, Kansas, and Nebraska. It was bought from Russia for $7,200,000. The fisheries alone have yielded over $50,000,000 in a single year and the gold mines in one year have produced three times the purchase price.

At the present time half the population, white and Indian, is engaged in the fishing industry, which has declined, for the reason that the fish have been so ruthlessly killed that the Department of Commerce has had to impose restrictions. On the other hand, the protection of the forests, with their 20,000,000 acres of spruce and hemlock, is in the hands of the Forest Service, with headquarters at Juneau, but acting under the Secretary of Agriculture. Again, the Navy Department has been operating coal mines in the Matanuska field and has spent a million dollars already in these operations, which it is proposed to place shortly in the care of the Secretary of the Interior. The complaint is made that this distribution of control among the various bureaus of the Government is paralyzing the industrial life of Alaska, and that the only remedy is to co-ordinate and consolidate the administration of the Territory. That is desirable, but it will not cure the *malaise* that has crippled the progress of Alaska. I am in agreement with Maurice D. Leehey, who, in an article appearing in 'Northwest Mining Truth' of February 15, insists that Alaska needs "a return to the simple freedom of individual opportunity which peopled and prospered the United States". Mr. Leehey claims that the withdrawal by the Government of the coal-lands in 1907, the futile prosecution of honest pioneers, and the enforcement of the Leasing Act have hindered development. The people of Alaska have no voice in their own government, they are governed by bureau chiefs that do not know either their circumstances or their needs; they are harassed by petty officials. The inevitable result is to discourage initiative, particularly on the part of the small operator, on whom depends the pioneer work requisite for the development of the North. It is noteworthy that one-fifth of the value of the products exported from Alaska in 1920 was copper, nearly all of which was produced by one big corporation. More than half of the exports was canned salmon, and most of this was shipped by half a dozen packing companies. Of the $8,000,000 of gold produced, more than half was from lode mines, and chiefly from the properties of two big companies. In 1920 only $3,630,000 of gold came from alluvial workings. The number of placer miners—the pioneers of industry—has diminished sadly during recent years.

The Federal Government has done much for Alaska; notably in building the railroad to Fairbanks, in establishing agricultural stations for the encouragement of farming and gardening, and, as we miners know, in conducting an elaborate series of geological investigations under the leadership of Mr. A. H. Brooks. These favors are appreciated by the Alaskans, but I think Federal help in developing the region has been frustrated, in large measure, by the restrictions on enterprise, particularly by means of the regulations applying to location and tenure of mineral land, and obstructions to prospecting offered by the Forestry Service.

The idea prevails in some circles that Alaska needs the interest and industrial participation of large capital, working under the patronage of the gentlemen at Washington. The people of Alaska are of the opinion that what is needed is more encouragement for the small operator. It is believed that this can be furthered by the passage of the bill for the better development of Alaskan resources introduced by Mr. Charles F. Curry, of the House Committee on Territories; and I note that at the recent Northwest Mining Convention at Spokane a resolution was passed endorsing this bill, "to the end that the several bureaus in Washington having to deal with the natural resources of Alaska be co-ordinated and united in so far as their Alaskan activities are concerned, with an authorized representative resident in Alaska". In the same resolution an early return was urged "to that liberal public-land policy which has been so successful in the Great West, both in the United States and Canada, by the encouragement it gave to individual initiative and pioneer effort". Unfortunately the affairs of Alaska are mainly in the hands of persons representing the populous parts of the United States, they are administered by individuals ignorant of conditions in the North, they are controlled by large corporations having headquarters many thousand miles from the scene of productive activity. The people of the Territory ask for a modified kind of home rule. For example, that stalwart Alaskan, Mr. Falcon Joslin, suggests an administration such as that of the Philippine Islands, with Commissioners of Public Lands, of Public Works, of Fisheries, of Education and Health, an Attorney General, and a Secretary Treasurer, appointed by the Governor and confirmed by the territorial Senate. To these departments would be delegated the duties exercised by the bureaus and commissions that now exist for the same purpose, at Washington and in Alaska. It seems fair that the people of Alaska should have at least as much self-government as the people of the Philippines; and I venture to add that the geographic distance that separates these outlying parts of the United States from the seat of Federal government is sufficient to explain the mistakes that have been made in administration and to justify the demand of the people of Alaska as expressed at the Spokane convention.

DISCUSSION

Russian Placer Mining

An Engineer with Long Experience in the Gold-Producing Region of the Country Presents Facts Respecting Recent Operations There

THE EDITOR:

Sir—When I criticized the American sluice (pp. 416-418, in the *Mining and Scientific Press* of March 26, 1921), condemning it as a poor washing appliance, I anticipated a rebuttal from C. W. Purington, the initiator of its introduction at the Lenskoe mines, but I expected his arguments would be based on technical reasoning, instead of on bookkeeping, and, as *ultima ratio,* on a testimonial of the board of directors of the Lenskoe Gold Mining Co. This testimonial is absurd, because in the year 1913-14 there was only one American sluice in operation on the Lenskoe mines—i.e., the one on the Feodosieffsky mine, which, after the misfortunes described in my article, finally started washing in July, 1914, and, as Mr. Purington well knows, until the end of the operating year it washed 25,000 cu.yd. at a maximum. This amounts to *less than 3 per cent of the year's total output of gravel washed.* It is obvious that so small a percentage could not possibly lower the average cost of washing, reduce the loss of gold, or have any of the other beneficial effects on the operations which Mr. Purington claims. The testimonial mentioned might have been unsolicited, but the board of directors was evidently led astray by the reports and statements of those, who particularly advocated the introduction of the American sluice at the Lenskoe mines.

Mr. Purington states that the final diminution of working costs was attained by improvements reducing the cost of the different manipulations. He is quite right, and no objection can be made to this, as it is the normal procedure, I should think, and certainly there was no hocus-pocusing at the Lenskoe mines. But everyone who has a thorough practical knowledge of mining operations, who has figured estimates of the output and prospective profits, and has had the responsibility for their fulfilment knows that improvements and reductions of cost in different manipulations become manifest only some time after the changes are accomplished, especially when these improvements and reductions have to be made gradually, keeping the operations going on at full speed without lowering the production. Under such circumstances, bookkeeping, for reasons with which every mine manager is familiar, does not reflect the saving on the different items immediately the changes are made, but some time after. This is exactly what happened at the Lenskoe mines, where the fundamental improvements made in every department by Russian engineers in 1913-14 revealed their full value at the time the mines came under the control of Messrs. Purington and Smith, who thus reaped the benefit of the efforts of the former. Thanks to this "curious coincidence," Mr. Purington ascribes the obtained diminution of costs to the "methods introduced by foreign engineers."

"The marked increase in yardage treated from drifting operations, comparing the seasons 1913-14 and 1914-15" is not a coincidence, as Mr. Purington equivocally says, but is due solely to the extensive development and preparatory work done in 1913-14, and the plan should have been followed instead of making "considerable modifications" which led to a gradual decrease of the output of gravel, as shown by Mr. Purington's table, relating to winter washing.

As for the increase in the gold production, which Mr. Purington ambiguously calls "recovery," it has nothing to do with foreign or other washing methods, being merely the result of the fabulous richness of the Bolshoi Chanchik Creek, which I discovered and prospected in 1913-14, and on which the workings were chiefly concentrated during 1914-15 and subsequent years. The great total drifting output for 1914-15 of $8,600,000 is a natural consequence of the rich contents per cubic yard of gravel treated.

One of the would-be foreign methods eulogized by Mr. Purington is the winter washing of the gravel, but he omits to mention that winter washing was introduced a year before the gentlemen named gained control of the operations at the Lenskoe mines; true, on an experimental scale, only with the purpose to ascertain whether under the rigorous climatic conditions on the Lena winter washing was profitably feasible. On account of the results of these experiments it became possible to develop winter washing further in the following seasons.

Mr. Purington states that for the winters 1916-17 and 1917-18 the percentage of gravel washed attained 36½ and 52½ per cent respectively, of the entire season's output. Quite so, but it appears that Mr. Purington does not fully understand the language of the figures he summarizes. In fact, these figures show a difference in the amount of winter-washed gravel of only 15½ per cent comparing the seasons 1914-15 and 1915-16, and a further microscopic increase of 4 per cent for the season 1916-17. These figures show further that the 52½ per cent of gravel washed in winter as mined was not by actual improvement and development of the method in question, but by a tremendous drop of 65½ per cent in the yearly output of the mines, from 873,835 cu.yd. in 1913-14 to 569,679 cu.yd. in 1916-17. This appears to be the final and most striking result of the much-lauded control of Messrs. Purington and Smith. Everybody will agree that such a result is contrary to the fundamental principle of all industry—efficiency.

The enormous decrease in the output cannot be attributed to war conditions, because up to 1918 the mines were furnished with all provisions and supplies necessary for the work, nor was there shortage in labor, as, according to a resolution passed by the Government Committee for Gold Mining Affairs, to which I was appointed representative of the Minister for Trade and Industry, all workmen on gold mines were exempted from conscription. The only draft occurred at the outbreak

of the war, at the end of July, 1914, during my management, when about 1,800 miners and eighty men of the staff superintendents, mine bosses, and foremen were called to the colors. But for this draft the year 1913-14 would by far have beaten all records concerning gravel output and washing on the Lenskoe mines.

Another feature of the control of the operations by Messrs. Purington and Smith was the erection, at the Tikhen mine, of a plant, consisting of a rope-way combined with an elevator, for the purpose of working the high bank of an old open cut. Mr. Purington told me of this plan soon after his first arrival at the Lenskoe mines, but I did not consider the scheme any further, as it was bound to fail. And so it did, when it was tried, after I had resigned, involving a heavy loss to the company.

Mr. Purington contends the trommel washing plants are inadaptable to winter washing. Such an affirmation is ridiculous, for according to the laws of heat transmission it is easier to heat a more or less parallelepipedal housing of a trommel plant from a central heating apparatus than the corridor-like extension of a sluice say 300 ft. long. Mammoth 17-ft. dredges are successfully heated on the Klondike and in Alaska, trommel, washing appliances, transmissions, digging apparatus, and all. Why not a stationary plant?

Apropos, no such trommel washing plants as were erected at the Schouvaloff and Lenskoe mines are used in Australia and California, as Mr. Purington states. The one he describes in Bulletin No. 263 of the U. S. Geological Survey is a parody of a modern Russian trommel washing plant and far more inadequate than even the old Siberian washing appliances. But, poor as it may be, this plant, from an engineering point of view, is infinitely superior to the long sluice, because, being based on the right principle of ore dressing, it can be improved in the details, whereas the idea of the sluice is primitive in itself, and not susceptible of improvement.

Mr. Purington thinks it a great advantage to dispose of the tailings by means of the transporting power of water. This system was extensively practiced on the Russian placer mines in times past, and abandoned as being a near-sighted policy, unless the local conditions of surface relief are exceptionally favorable. Distribution of the tailings by the transporting power of water may prove economical for a year or two at the beginning of operations, or while working on a small scale, but if 700,000 to 800,000 cu.yd. of tailings are annually in the course of many, say ten or fifteen, years carried away by the water courses the result will infallibly be that all flumes, water races, and ditches, and even the rivers themselves, will be choked with sand, silt, and mud, which would threaten the very existence of an enterprise wholly dependent on water-power, as are the Lenskoe mines. This would cause a lot of trouble at the power stations, wearing out the turbines and so on. Besides, the underground workings would surely be flooded in a short time, as a consequence of the obstruction of the natural drainage system.

Mr. Purington asserts, that I "attack well-established methods of mining alluvial gold," and omit "a general criticism of gravel mining methods in all countries outside Russia."

This sounds like German war-sophism. I am the defender; Mr. Purington is the assailant. In the editorial of the *Press* of March 19, 1921, there is defined in a few concise words the aim of my articles, which was to combat erroneous ideas about Russian placer mining propagated by articles such as Mr. Purington's contribution to the issue of Sept. 6, 1919, of the *Press*, which appeared also a couple of months earlier in the English edition of the Vladivostok paper *Echo* for June 21, 22, and 23, 1919.

Facts are facts, and the failure of all foreign gold placer enterprises in Russia, with the few exceptions I mentioned, is manifest to all who in one way or the other have been connected with the disasters. Having had during thirty years of activity in Russian placer mining the opportunity of watching most of the foreign enterprises from the start to their final debacle, I have tried to explain the reasons for these wholesale failures as I saw them, and I wanted at the same time to give, as far as is possible within the scope of a few columns, a general picture of Russian placer mining methods, their origin, and all the factors having an influence on their development. My remarks on individual mining undertakings, the Lenskoe, the Kolchan, the Schouvaloff, and other placer mines, were cited as illustrations only in support of my statements concerning the different gold-producing regions of Russia, in which conditions, naturally, vary greatly, the gold fields being scattered over a territory covering, as Mr. Purington rightly remarks, a lateral range of eighty degrees of longitude, and, I may add, ten degrees of latitude.

It would have been of interest and would better have served the purpose if Mr. Purington had given his explanation as to the causes of the failure of foreign ventures in Russian placer mining, instead of limiting his arguments to the Lenskoe property only and making a technical controversy a personal issue. W. E. Thorne's letter published in the *Press* of Dec. 31, 1921, fully explains the real situation. L. A. PERRET.

Yokohama, Japan.

Inconsistencies in Mine Depletion Acts

THE EDITOR:

Sir—The acts of Congress under which depletion deductions are being made by mines, provide as follows:

Act of 1918: A reasonable allowance for depletion not to exceed the market value in the mine or the product thereof which has been mined and sold during the year for which the return and computation are made. Provided, that when the allowance authorized shall equal the capital originally invested, or in case of purchase made prior to March 1, 1913, the fair market value as of that date, no further allowance shall be made.

Act of 1919: A reasonable allowance based upon cost, including cost of development not otherwise deducted. In case of a mine operated by the discoverer, the fair market value at the time of discovery or thirty days thereafter.

Act of 1921: A reasonable allowance for depletion and for depreciation of improvements according to the peculiar conditions in each case based upon cost, including cost of development not otherwise deducted. Provided, that in the case of such properties acquired prior to March 1, 1913, the fair market value of the property (or the taxpayer's interest therein) on that date shall be taken in lieu of the cost up to that date.

The joker in each of these three acts is the words "The fair market value at that date" (March 1, 1913).

The act of 1918 provides that "when the allowance authorized shall equal the capital originally invested"; thus basing it on cost. The act of 1919 states "a reasonable allowance based upon cost." The act of 1921 states also "based upon cost." But in all three acts, in the case of property acquired previous to March 1, 1913, "the fair market value" is stipulated.

Therefore, let us take a concrete example: A mine was purchased on March 1, 1913, for $100,000. Under the wording of all three acts, only $100,000 depletion can be taken, development costs being taken care of as a charge to the ore when mined. Had that same mine been purchased on Feb. 28, 1913, the purchase price being the same, according to the wording of all three acts, the $100,000 purchase price can be designated and the "fair market value" as of the next day guessed at, which of course will be more than the purchase price, because no one pays $100,000 for a mine if he thinks there is only that much in value of metal in it.

After passing a few more acts regarding depletion, someone in the Congress may think of having an act drawn to provide, "That in case of a mine purchased prior to March 1, 1913, the cost, less the value which has been extracted from the date of purchase up to March 1, 1913, will be the amount to be taken after that date as a depletion allowance, to be pro rated over the units of metal or ore mined subsequent to that date, on the same basis as that on which the amount subject to depletion on that date was arrived at."

That will say what the Congress has been trying unsuccessfully to say for several years. As above illustrated, why should a company purchasing a mine on March 1, 1913, be allowed to take as depletion only its purchase price, when, had the company bought the property on Feb. 28, 1913, it could take any amount as the "fair market value" as of the next day which it is able to "put over"?

And in the case of the discoverer who is operating the mine, why should he be allowed any depletion deduction? The Government gave it to him. His development costs are taken care of as a charge to mining when the ore is mined. C. B. HOLMES.

Albuquerque, N. M.

Oil Leases and Contesting Claimants

THE EDITOR:

Sir—In the act of Congress relating to oil and gas prospecting permits, Sec. 13 states that:

"The Secretary of the Interior is hereby authorized under such necessary and proper rules and regulations as he may prescribe, to grant to any applicant qualified under this act a prospecting permit . . ."

On page 8 of Circular 672 of the regulations of the General Land Office is the plain statement:

"It should be understood that under the act, the granting of a prospecting permit for oil or gas is discretionary with the Secretary of the Interior, and any application may be granted or denied, either in part or in its entirety, as the facts may be deemed to warrant."

In July, 1921, an application was filed for a permit upon land already covered by a previous permit, and a contest filed for the land, the second applicant alleging that the first permittee had lost his rights by failing to drill the land within the time specified by the regulations. This contest was rejected and dismissed and the fact noted on the records of the local land office.

In the Los Angeles *Oil Age* of August, 1921, was published a letter from the Assistant Commissioner of the General Land Office, George R. Wickham, in which that gentleman refers to a letter from his office to the Register and Receiver of the Visalia Land Office, wherein it was held that:

"To allow contests against permits for such purpose would be to invite endless litigation, which would tend to defeat the very purpose of the oil and gas leasing act, to wit: development of the oil and gas resources of the country . . . The only question raised by the protest is whether an oil and gas permit is subject to contest by a third party. The only parties in the case of an oil and gas permit are the permittee and the United States, and a contestant could acquire no preference right to a permit, though the contest were sustained and the permit cancelled. The enforcement of the stipulations in the permit rests with the department, and contest by a third party is not the proper procedure in such cases."

It would seem to the uninitiated that the matter was ended by such plain statements, made public by letter to the press from the General Land Office and backed by the undoubted authority of the department to decide the question; but it must not be forgotten that the "endless litigation" referred to would be a source of endless fees for land lawyers, and the latter are human.

Owing to the failure of a wildcat well in the region, the right to oil in the land is not now considered of much value, and the "urge" behind the matter must be from those who would be most benefited by a reversal of the commissioner's former decision and the inevitable "endless litigation."

There are many regulations regarding the working and development of permits, and if failure to drill within proper time makes them liable to "jumping," then any minor infraction of the rules would legally have the same effect, and chaos would follow.

Many tracts under permit were not drilled in accordance with the regulations, owing to the financial stringency of 1921. A recent act of Congress allows the Commissioner of the Land Office to extend the time of such permits if he so decides; but will the extension of an invalid permit validate it? Especially, will the title be good in court afterward if oil is discovered on the land?

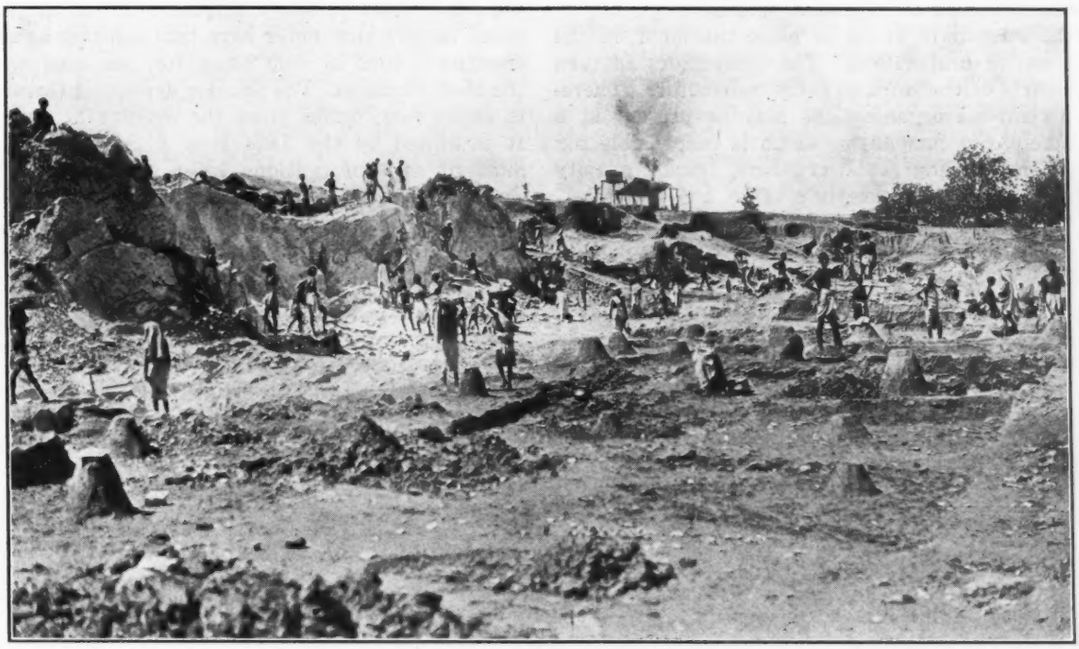
Must permit holders expect that as soon as they discover oil their claims will be "jumped"? It will be a pleasant prospect for land lawyers, and will increase fees in local land offices, but will make it extremely hard to interest capital in oil development under the permits.

The wearisome litigation occasioned by the Taft withdrawals has made investors "shy" of dealing in Government leases, and if to their fears there be added the danger of claim jumping, the intent of the oil and gas leasing bill will certainly be defeated.

It would naturally be expected that the commissioner would certainly decide this case as formerly, but great pressure will be brought to bear on him to do otherwise and to allow this first "jumping" application. With that precedent the flood gates will open.

To the mind of an engineer, the proper way to avoid rupture of a fixed (and high quality) support, liable to be strained beyond its limit, is to oppose an opposite strain. I therefore suggest that each reader of this letter cut it out and send it to his Congressional representative with a request that that gentleman's weight be added to such opposite strain.

Los Angeles, Cal. M. A. KNAPP.



Mining iron ore at Gorumahisani, Mayurbhanj State, India, showing "witnesses" used in measuring work done

Coolie Labor in India

Mining Operations Lack Sufficient Workers, in Spite of Large Population—Contractors Are Depended on for Supply, Which They Often Fail To Furnish—Characteristics of the Natives

By H. J. Volker

AT FIRST THOUGHT the teeming millions of the East should seemingly provide ample labor for every enterprise conducted there. It is, however, my experience that though India may have 300,000,000 inhabitants, there are almost as many excuses for avoiding mining work. In fact, the Westerner's whole conception of a "job" is changed in India, where the coolies' work, other than that of the fields, is not taken seriously, and is a family matter, to be indulged in only on rare occasions.

Those starting enterprises in India should not, therefore, be misled into a belief that operations there are free from labor troubles because of the density of population or the cheapness of coolie labor. In India, it is not unusual to see coolies sitting on the "bunds" of their rice fields doing absolutely nothing as far as the observer can see. But it is not to be supposed that coolies thus occupied are available for work at a mine. For, despite the density of population in India, labor is not abundant there. In fact, abundance of population and abundance of population that is willing to work for the mine operator are dissimilar terms.

The mining work (open cut only) that I have observed is not taken seriously by the coolie. He is assigned a certain stretch of territory, and, when it is his desire to work, he comes with his household effects, his goats, babies, adolescent and adult members of his family and game cocks, for he loves a cock fight and indulges in this form of amusement every bazaar day. Although the work that he does is piece work, one sees none of the feverish activity that might be expected under that class of payment. All able-bodied members of the family work in a leisurely manner—children, wife, and husband. Although this looks like child labor with a vengeance, it really is not, as it is open-air occupation, and the children are as often playing with each other as helping their parents.

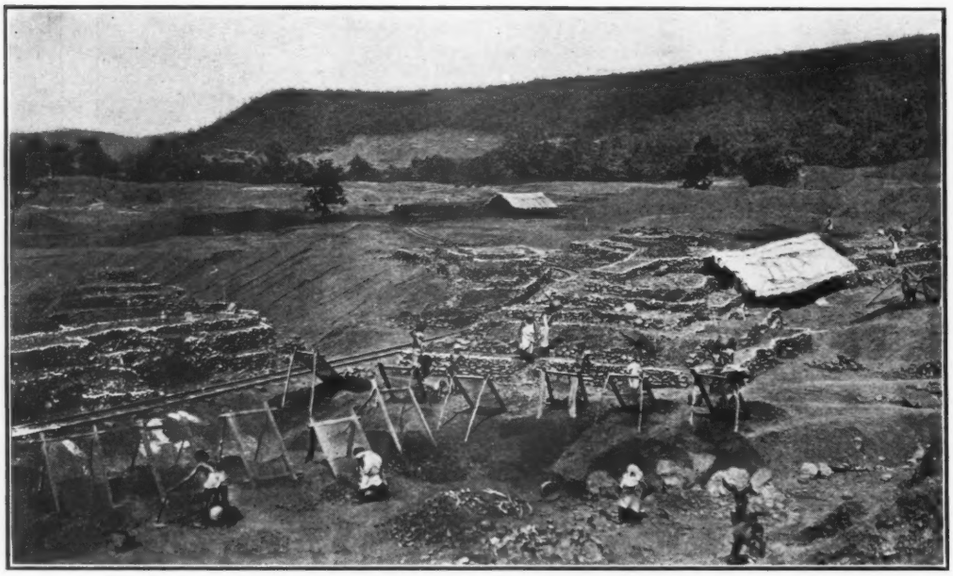
Large Operations More Affected Than Small

Then, the coolie comes to work quite irregularly. The monsoons, of course, are the most aggravating causes for his non-appearance, for it is then that he is planting rice, transplanting it, and doing other work in the fields. But there are also many festivals which demand his attention. For small-scale operations, this seasonal availability of the coolie may not be a serious detriment, but for those conducted on a large scale, where regularity is necessary, entire dependence upon such labor is unwarranted. In small-scale work, the entire community is not drained, and even during the monsoon a certain amount of labor is available, because of an overlapping in point of time of the various rice-field occupations. But in large-scale work, the community may be almost completely drained, so that a seasonal diminution is serious.

Of course, in mining work the practice is followed of using stockpiles to act as a balance wheel. But the natural fluctuation of mine labor is so large that an

enormous stockpile at a smelter becomes essential. This may be impracticable from several reasons.

It is the custom in India to place the labor in the hands of native contractors. The contractors in turn may give parts of the work to petty contractors. Therefore, two complete organizations may be present at a mine—namely, the company's, which is responsible for the equipment (rolling stock, crushers, tracks, gravity planes, machine shop, surveyor's office and the like), and the contractor's, which is responsible for the labor to do the unskilled work of mining, loading, and certain other jobs. This means that the contractor is a labor specialist. The arrangement appears to be an inefficient way to handle a job, and it is, but it saves the company a great deal of worry about labor supply. The company usually has enough worry without having to solve the labor problem.



Ore stacks and screen used at Gorumahisani

The fluctuations in labor may be as violent as from about 3,000 miners daily to 750, with the ore mined dropping from 74,000 tons in a month to 20,000 and less. These figures provide an indication of what to expect when complete dependence is placed upon labor. It is this fluctuation that forces large mining operators in India to realize that "cheap Indian labor" is a dangerous shibboleth; that in dealing with it alone, total dependence is being placed upon an unreliable element, and that where large output is demanded machinery must be installed.

Iron Ore Abundant

In several states of India rich deposits of hematite occur. These sometimes consist of ore in place as the principal supply and again as boulders. The latter, of course, are the more easily worked. At Gorumahisani, in Mayurbhanj State, the ore occurs as boulders mixed with earth, the whole as a blanket from a few feet to perhaps 20 ft. thick covering parts of the mountain and its lower reaches. The extent of the remaining ore in place from which the boulders have been eroded is not definitely known, but it is probable that the boulders form the chief supply.

The amount of ore that is contained in several deposits in place, other than at Gorumahisani, is enormous. The reserves of Indian iron ore are such that cheap pig iron should be easily obtained. There are, however, other factors that enter here that militate against final cheapness, such as long hauls for flux, coal and ore to the blast furnaces. The boulder deposit at Gorumahisani is about forty miles from the smelter at Jamshedpur. It is owned by the Tata Iron & Steel Co., Ltd., and most of my observations refer to conditions as seen there, although I believe that my conclusions regarding labor apply fairly generally throughout India.

Operations at Mayurbhanj depend on coolie labor. These coolies are simple, tractable, and childlike. They come under the general head of Dravidians, and in the region discussed several tribes of Dravidians are available. Among these are the Santals, the Kols, the Bumij, and the Oraons. The main consideration of these people is their rice fields, and when such work calls them, the difficulties of maintaining a large force at the mine are enormous and I believe practically beyond solution. Other work is secondary to them at these times.

To offset the depletion of labor during the rice-growing season, the contractor conducts a vigorous recruiting campaign, but in spite of all, the results at Gorumahisani show that "good" labor conditions occur only during February, March, April, and October. In January, festivals break up what should be, from crop considerations, a good month. May is an exceedingly hot month, and labor is not inclined to work. From June to September monsoons keep most of the coolies at their fields. In October a slight betterment occurs, but November and December are reaping and threshing months, so again the labor supply is poor.

Mining and Loading Done by Contractor

Labor operations at Gorumahisani are divided into mining and loading. These are done by the contractor. The company trams the ore to gyratory crushers from the place of loading in V-bottom side-dump cars, or "tubs," of 25-cu.ft. capacity (1.7 long tons) and 2-ft. gage, in trains of from sixteen to twenty tubs, by steam locomotives. From the crushers the ore goes direct into ore cars on the Bengal Nagpur broad-gage railway and is hauled to the smelter.

Mining consists simply in picking out the boulders and pebbles of hematite from the earth in which they are mixed. Sometimes the boulders are so large that blasting is required. As nearly all the boulders and pebbles are ore, and almost none of them granite or other waste, screens were introduced as a twentieth century improvement. This meant that the coolies simply had to throw the "run of mine" on a ½-in. screen and the oversize was ore. Even this small improvement took a deal of persuasion, as the coolie is a conservative.

Upon the miner devolves the work of stacking. Therefore during the week he roughly assembles the fruits of his labor in a pile and then takes all of one day to stack it in blocks called *pavas*, which are 7½ ft. square and 1 ft. high. The miner is then paid by the contractor at varying prices per *pava*, the price depending upon the amount of ore mixed in the bank, the distance from the working place to the *pava*, the latter being placed as near as possible to the tram line, either existing or proposed, and the amount, if any, of barren earth that may be on the top of the blanket of mixed earth and ore. Each *pava* contains, at 16 cu.ft. per long ton, about three and one-half tons, and the labor of mining and stacking costs from Rs. 1-0-0 to Rs. 1-10-6 per *pava*, depending upon conditions. The records show that without screens the capacity per miner is slightly over half a long ton per day; but with screens, the capacity is nearly one ton.

Week Has Four Working Days

The coolie has only four working days per week in which he actually engages in extracting ore. Sunday is measurement and pay day. Monday is a day of rest, Tuesday to Friday are mining days, and Saturday is set aside for stacking! In giving the above estimate of a miner's capacity his week's winnings are divided by six. The inefficiency of this system is apparent, and stacking seems to take at least one-sixth of the miner's time. To a limited extent this is avoided by loading into tubs direct from the first rough piles and paying the coolie per tub. This is not possible in all operations, for several reasons. First, the amount of ore mined is often far in excess of that loaded. Second, if the two operations could be equalized, the amount of rolling stock necessary would be excessively large, as the area covered at Gorumahisani is extensive. Third, with equal mining and loading a stockpile would, of course, not materialize, and it is desirable to have one at the mine, especially in consideration of the unreliability of the miner, weather difficulties, and the like. Storage in bins, to be drawn as desired from chutes, may not be practicable, as the area is large and working faces advance rapidly, and, in addition, timber construction is expensive. Furthermore, changes in general are difficult because of the conservative nature of the coolies.

The loading of ore, except as noted, is done from large stacks by special gangs of loaders. It is usually found that a gang of eighty coolies per rake of twenty tubs is best. At each tub three women (called *rejahs*) and one male coolie are placed. It is found that the capacity per coolie is about three and one-half tons per day. In fact from eight to eleven trips are made per rake of tubs, a great deal depending upon the load, the weather, and the ability of the loaders. This operation is done both by day labor and by piece work. Perhaps, on the whole, day labor is the more satisfactory, for here regularity of output is so essential that the added control under which daily labor works is desirable. Under this arrangement the cost of day labor is no greater than that of piece work. The reason is that in piece work the petty contractor reaps a rather higher profit than with the other work because it is so important that he bring all his loaders to work that an extra monetary inducement is given him. Also, the number of loaders is small, so that far more attention can be given here than to mining. This part of the work is the most difficult for the contractor. By virtue of his ore stacks, his mining operations can fluctuate as widely as the weather. It is of no importance so long as his stockpiles are never exhausted, and it turns out that he maintains them in ample size with little trouble. But the loading must be regular. And the fickleness of the coolie, to say nothing of incidental difficulties, makes this task severe. This difficulty is enhanced by limitations placed upon the stockpile at the smelter, and by failure to obtain a sufficient number of ore cars from the railway during the times when labor is abundant.

Settlements Built for Coolies

To obviate the difficulty of an unstable labor supply, the contractor builds settlements or camps, which he tries to fill with coolies who depend upon him alone for their living—that is, with coolies who have no fields. This, of course, helps a great deal, but here, also, coolies who have more fields than they can tend hire the resident coolies, and, pastoral work being always preferred, the old difficulty ever remains. Also, during the whole of the monsoons, continual absconding of recruited coolies takes place. If such a thing as an epidemic occurs, like cholera, the coolies becomes terrified, and whole droves of them will leave. In the midst of this trouble the contractor may find that his newest and best coolie houses have been "tabooed"; that the superstitious coolie believes that he will contract cholera if he lives there, and no amount of incantations or *pujahs*, or sacrifices of goats, pigs, and chickens will reinstate the said houses to favor. This condition I have witnessed after a cholera epidemic so that the best houses (made of sun-dried bricks, and roofed with tile) had to be abandoned, the only salvable thing being the tiles on the roofs.

In the tea gardens of India the coolies are given small plots of ground which they till and thus grow vegetables. In this way the absconding is prevented. This may not be practicable if the tillable fields have already been taken up by resident coolies.

Is Hand Labor Desirable?

It is at this point that one must consider whether it is desirable to use hand labor in India or not. The cost is undeniably low. It seems, however, that when regularity of a large output is demanded, machinery is far more desirable, even though at an apparently higher cost. Thus, at Gorumahisani the problem boils down to one of loading. Therefore, if a machine could be introduced to work at all times, regularity would be assured. The point to be emphasized is that in Indian operations labor is not abundant, that is *available* labor. Furthermore, it is unreliable and absolutely subject to occupations which are seasonal.

Some other of the primitive methods in use in India are shown in the accompanying illustrations. The blast furnace works on a charge of finely broken iron ore and charcoal. The bellows are pots covered with goat skin. Air is admitted through a hole in the latter, which is covered by the operator's heel when he forces the air into the furnace on the downward stroke. The photograph of the quarry that has been flooded shows a peculiarity in earth removal. This is the "witness." It will be observed that several small pillars appear in the picture. These have been left by the coolie to show the level at which his block of earth was before excavating. Needless to say there are various methods of increasing the height of the "witness" after the work of excavation!

The Wrong Word

BY T. A. RICKARD

FLAUBERT, as we know, laid stress on the selection of the right word, *le mot juste*, the precise epithet, "the word that belongs" to the thing. A sentence, or even a paragraph, may be spoiled by the use of a word that is not proper, that does not fit, or is foreign to the meaning intended.

An Australian mining expert is reported to have said:

You have a property of considerable value, and what I saw warrants a good development of very rich **cubicular** galena, with gossan intermixed.

"Cubicular" means "belonging to a small bedroom," a "cubicle" being a sleeping compartment. He meant "cubic," of course. This is a malapropism, and reminds me of the lady from Chicago that, on her return from Europe, said how much she had enjoyed the rural parts of France, because, among other things, it was "so delightful to hear the French pheasants singing the mayonnaise."

It is impossible to **amalgamate** coal-tar thoroughly with the pulp in the agitating-tank.

In metallurgy, "amalgamate" refers to the combination of mercury with one or both of the precious metals, forming an amalgam, which is an alloy of mercury with another metal. It differs from other alloys, such as brass or bronze, in being made without the aid of heat, because mercury will melt at an ordinary temperature. The word comes to us from the Greek through Old French and means "something soft." It is a mistake to use technical terms, having a specific meaning, for purposes that are foreign to that meaning. The writer of the quotation is not discussing any combination of metals; he is dealing with the physical process of mixing and is using "amalgamate" wrongly as a synonym for "mix intimately" or "emulsify." The effect is confusing.

The **classical** formula $P = 2\pi$ should be abandoned.

He was referring to a familiar formula in physics. "Classical" refers to that which is of standard excellence in literature. "Classic" means "of acknowledged excellence." It is not the right word in such a context, though preferable to "classical," which usually connotes Greek or Latin. He meant no more than "well-known" or "generally accepted."

The orebodies are reported to be more **permanent** than is usual in limestone.

If a thing be permanent, that suffices; it "stays put," as it were; one thing cannot be "more" permanent than another, but one thing may be either more or less impermanent than its neighbor, according as it is moved sooner or later. The geologist or pseudo-geologist whom I have just quoted did not mean "permanent," but "persistent." "Permanent" means "lasting" or "intended to last"; for example, a permanent foundation. When ore is found in a mine it is not intended to last or to be left where it is; the intention is to remove it to the surface for the purpose of extracting the valuable metal or metals that it may contain. "Persistent" is "to continue in a course"; when applied to ore it means "continuous," as against "patchy" or "interrupted" in its extension.

The particles of mineral may become attached to the air-bubbles by means of which they are **floated up** to the surface.

A thing does not float until it rests on the surface; the mineral particles levitate to the surface by aid of the rising bubbles. "Levitate" means to rise by reason of lightness, from the Latin *levis*, light; it is the antonym of "gravitate."

Senator Harding will advocate measures designed to promote increased production of the **necessities** [necessaries] of life.

Of necessities there are too many already; it were cruel to make more. "Necessity" means a state of need, the lack of things that are indispensable; "necessaries" means the things that are needed. This misuse of "necessities" is common. In Spanish the same distinction obtains between *necesidad* and *necesario*.

The phenomenal **emergency** [emergence] of a great American merchant marine is one of the most striking economic consequences of the World War.

This is taken from Mr. Harding's speech accepting nomination to the Presidency. "Emergency" means a "sudden juncture demanding immediate action." "Emergence" means "coming out of" or "issuing from." He meant that the creation of the mercantile marine was one of the extraordinary results of the war. "Phenomenal" is redundant; if it was "the most striking" it must have been highly extraordinary, which is the sense in which "phenomenal" is used in this context.

The wolfram is of a very friable nature, and, as the quartz gangue is the **medium** of crushing the molybdenite, a happy **medium** has to be **struck** in the size of battery screens, care being taken to slime the wolfram as little as possible and to crush the molybdenite as much as possible.

The use of "medium" in two senses within the same context is a blunder; moreover, in both cases it is the wrong word, for the first "medium" should be "means" and the second one should be "mean." The idiomatic phrase is to "strike a happy mean." The crushing is not done through the quartz but by means of the quartz, which abrades the soft molybdenite when brought in violent contact with it inside the tube-mill. The word "struck" is unfortunate because the ore is struck by the stamp in the mill, and it savors of a pun to say that "a happy medium" is "struck" in "the size of battery-screens." The phraseology as a whole is muddled and confusing. "Struck" means "chosen." The "very" before "friable" says nothing, for there is no standard of comparison. The entire statement needs rewriting, but is so obscure that I hesitate to offer a substitute.

The old furnaces are being **torn out** and **substituted** with others of larger capacity.

A substitute is a person or thing that performs some function instead of another person or thing; the larger furnace would not be a substitute for the smaller furnace, because it would do more work in a given time, and possibly it might do that work with greater metallurgic efficiency; that is, it would take the place of the smaller furnace with economic advantage. "Torn out" is not a word that fits this technical context. I suggest:

"The old furnaces are being dismantled and will be replaced by others of larger capacity."

One of the springs of unrest in Ireland is that the Land Acts have only been **partial** [incomplete] in their operation.

If Ireland has been governed badly, it is likely that the laws regulating the tenure of land have been administered unfairly; as to that, we are not meant to be informed in the foregoing quotation. The context shows that the writer intended to convey the idea that the Land Acts had been "only partly effective in their operation."

The Paris conference attempted **partially** to meet the issue by providing that the development of resources in mandatory countries should be managed to the best interest of all nations in the League.

The Paris conference may have acted partially or shown itself partial in some of its decisions, but the meaning here is "incompletely" or "without entire success."

The temperature is much too high for **economic** [economical] practice.

"Economical" means cheap or thrifty; "economic" relates to economics, or political economy.

The new method permits the **economic** [economical] leaching of the entire output of the mine.

I do not overlook the fact that the primary meaning of one word may be the same as the secondary meaning of another, but it should be obvious that the use of words in their primary meaning serves to clarify writing and also to enlarge the vocabulary of the writer by putting each word to its proper function, whereas, the use of words in their secondary meaning produces, or may produce, confusion; moreover, it has the effect of crippling the writer's vocabulary.

Words may have several meanings; most words have a primary or usual meaning, and after that they have their secondary meanings. Take such a word as "economic"; it is the adjective corresponding to "economics"—that is, relating to the science that deals with the production and distribution of wealth. "Economical" primarily means "saving" or "thrifty," but it can also be used in the sense of economic. Again, take "proposition." Its primary meaning is a "statement" or "assertion," yet it is used commonly instead of "proposal," a proposing of something, an offer put forward for consideration.

Now, if we use the wrong word—that is, the word that does not fit—we spoil our vocabulary. The man who uses "economical" for "economic," and "proposition" for "proposal", has only two words in his vocabulary, whereas he who uses these words in their primary meaning has four words at his service. Moreover, the man who uses words interchangeably, making them do duty for various meanings, will fail to convey his ideas as clearly as he who holds each word to its primary function. One can find other examples in the writings of mining engineers. For example, "locate." Its primary meaning to a miner is the marking of a claim; that is to say, its technical use is its principal function in affairs dealing with mining. Its common meaning, "to establish in a place", is considered a secondary one by an intelligent writer on mining affairs, and for that meaning he chooses another word. A writer may say that "the mill was located" in the same context as the one in which he speaks of "locating the mill-site." In the first phrase he means that the building, with its contained machinery, was "erected" or "constructed" at a certain place; in the second he means that certain legal formalities were fulfilled for the purpose of securing the ground on which such a plant is to be placed. He will speak undiscriminatingly of "locating a claim" and of "locating the orebody," the latter signifying the finding of the orebody or the obtaining of evidence that determines the position of the orebody.

It is best, in technical writing, to hold technical words to their technical meaning. We have seen how "amalgamate" was used as a synonym for "mix," although in the technology of metallurgy the word "amalgamate" has a precise meaning—namely, the alloying of mercury with gold or silver. A technical writer should not speak of the "amalgamation" of a group of companies or corporations, because he is distorting the precise meaning of a common technical term, and because he has other words, such as "consolidation" or "combination," at his disposal. Again, we read about the solution of a problem and we are told that a problem is "insoluble." In chemistry, one of the sciences helpful to the art of mining, this word "insoluble" means something that cannot be dissolved—in water, acid, or some other specified liquid. We have the word "unsolvable" as the adjective appropriate to the solution of a problem; why not, then, use "unsolvable" for the problem and "insoluble" for the metal or mineral? If this be done, two words are available, each with its own distinctive meaning; thus we shall avoid the confusion of thought that arises when we are discussing problems of metallurgy in which the solving of troubles and the dissolving of refractory substances have to be discussed in the same context.

A **native** [domestic] fuel-supply is assured.

An industrial product is domestic; a human product is native. The word "ship" is of the feminine gender; the animal "mare" is of the female sex.

Like others of my **ilk** [fraternity or profession] I have devoted much thought to the subject.

"Ilk" means "of that same," and is used when a person has the same name as his estate, as Guthrie of Guthrie. The use of it in the above quotation is incorrect.

The German **vegetable-fibre** industry.

One might suppose that the word "vegetal" did not exist; for it is rarely used. "Vegetable" at once suggests peas, carrots, and cabbages, and so switches the thought in the wrong direction. The adjective of "vegetation" is "vegetal"; we ought to speak of "the animal, vegetal, and mineral kingdoms." Neither flax nor hemp, neither sisal nor hennequin, is a vegetable, nor is it of vegetable origin; they are vegetal fibers. Asbestos is a mineral fiber.

The use of the wrong word causes a derailment of thought from the intended line of reasoning; it evokes an image that is incongruous. Every inapt word is an obstacle to the communication of ideas; it is like a hurdle that has to be jumped or evaded; the effort is tiring to the reader, and if it be repeated he may be pardoned for declining to proceed.

It may be argued that it is **unethical** [improper] for a Senator to be retained in a lawsuit of this kind.

An imposing word is used incorrectly. "Ethical" means relating to morals or to the science of ethics. All that the writer meant was that the Senator's retainer was in bad taste or contrary to etiquette.

Since the **dawn** of cyanidation, the most surprising methods of anticipating the results of practical operations have been in vogue.

The poetic word "dawn" is incongruous with the remainder of the statement; it conveys no clear idea. The writer means "since cyanidation was first introduced" or "since the beginning" of the process. "Practical" is redundant. Another word frequently misused for the same purpose as "dawn" is "advent." Thus:

The **advent** of the flotation process led to the reconstruction of the mill.

"Advent" is the season before the Nativity; it may be used figuratively for any important arrival, but it is wholly inappropriate to the introduction, beginning, or first application of a metallurgic process.

This method is applied **universally** [generally] throughout the province of Huelva.

Huelva is a province of Spain, not a universe. The word "universally" is too comprehensive; it is a fine and large word that should not be used in a context wherein the idea of limitation is implicit. In this quotation it is redundant, for "throughout" suffices.

The results are good when the **universal** [general] high cost of operations is considered.

Here the meaning has a wider range, but even in this quotation the writer is thinking only of the copper-mining industry of the United States, not of the entire world.

The word "cosmopolitan" is used in a similarly incorrect way. A man may travel around the world without becoming "cosmopolitan"; on the contrary, he may be as provincial, even as parochial, when he returns as when he started on his journey. A gathering is not "cosmopolitan" because it includes an American, a Frenchman, a Spaniard, and a Greek; it is only international in its character. A group of men of the same nationality may be "cosmopolitan." "Cosmopolitan" means "free from national prejudice" or "belonging to all parts of the world." It is used wrongly in the following, taken from a local newspaper:

To give a **cosmopolitan** flavor to the function a light refreshment was served, after which the joyous participants **departed for their domiciles** [they were too "cosmopolitan" to go home, of course] with the happy reminiscence of having spent a wondrous evening [and with the "light refreshment"].

In short, "a good time was had," as might be said by the society reporter of the "Podunk Gazette," which probably would be considered locally a highly "cosmopolitan" newspaper.

A word may be overworked, particularly by the illiterate, to such an extent as to render it undesirable in serious writing. For example, "eliminate." This word is belabored to death by every newspaper scribbler, so that the use of it becomes a tiresome vulgarism. It appears, with wearisome iteration, in descriptions of golf.

The last American professional was **eliminated** in the qualifying rounds of the tournament at Glen Eagles today. T. G. Renouf, of Manchester, **eliminated** Walter Hagen, of Detroit . . . Jock Hutchison was **eliminated** by Abe Mitchell.

To "eliminate" is to "remove" or "get rid of." Therefore the usage in the quotation is correct; but as the defeat of a player in match-play during a tournament involves his elimination, it is better to use the simpler word. I suggest:

"The last American was eliminated in the qualifying rounds of the tournament at Glen Eagles today. T. G. Renouf, of Manchester, defeated Walter Hagen, and Abe Mitchell won from Jock Hutchinson."

In this way it was possible to wash the whole of the winter output and **eliminate** the collection of winter dumps completely.

Here "eliminate" is used for "avoid" or "cease" doing something—namely, the making of a winter dump, that is, the storage of gold-bearing gravel at a mine in Alaska. The adverb "completely" should follow the verb, otherwise it may seem to modify "collection."

A distinguished administrator, referring to the Federal Government, says:

We must proceed to the **elimination** of duplication of the work in the various departments.

Here again "elimination" is not wrong, but the use of two long words ending in "ion" is ugly; moreover the active verb is stronger and clearer than the abstract phrase. He means that it is high time to stop duplicating.

The common misuse of "eliminate" is illustrated by the following story:

Two men were in a dining-car ordering breakfast. The first one said to the waiter:

"George, you may bring me two fried eggs, some broiled Virginia ham, a pot of coffee, and some rolls."

"Yessa."

The other said:

"You may bring me the same."

"Yessa."

The second man then called after the waiter and remarked:

"Just eliminate the eggs."

"Yessa."

In a moment the waiter came back.

" 'Scuse me, boss, but just what did you all say erbout dem aigs?"

"I said just eliminate the eggs."

"Yessa." And he hurried again to the tiny kitchen.

In another moment he came back once more, leaned confidentially and penitently over the table and said:

"We had a bad accident jest afo' we leave de depot dis mornin', boss, an' de 'liminator done got busted off, right at de handle. Will you take 'em fried same as dis hyar gemman?"

Twelve thousand persons watched these two young **tyros** in their battle for the big silver cup **on which** the names of leaders dating back to the beginning of things in golf were inscribed **on it.**

So says a writer in the New York *Times* when describing the final match in the amateur championship. The two players were champions, one became champion at the end of the match that is being described and the other was an ex-champion; they were the very opposite of a "tyro," which means a beginner or novice, from the Latin *tiro*, a recruit. Note that the writer himself appears to be a tyro in writing, for he repeats the preposition "on" clumsily.

The average number of deaths in Mexico City **only** [alone] was 20,000.

At first the idea is that only 20,000 deaths were recorded, whereas the writer means that in the one city the number of deaths was 20,000.

The native women wear gay shawls and much **meretricious** finery; the men wrap themselves in blankets of brilliant colors.

This mining enterprise would have continued to prosper

if the president of the company had not introduced his **meretricious** methods of mining finance.

Here a word that is deeply significant if used with correct reference to its derivation is applied carelessly and inaptly. "Meretricious" comes from the Latin *meretrix*, meaning "harlot." To speak of the finery of the native women as "meretricious" is to convey a suggestion that evidently is not intended. The writer meant "gaudy" or "bright"—nothing sinister was implied. In the next quotation the word is used in place of "flamboyant" or "tricky"; it is a usage not without precedent, but it is objectionable, because it spoils the word for effective employment, as for example in referring to the prostituted journalism of Hearst and Brisbane.

"Lay" and "lie" are used wrongly, partly because most people forget that "lay" is not only a verb distinct from "lie" but also the past tense of "lie." Moreover, "lay" is transitive; it requires a direct object.

He **laid** [lay] awake.
The limestone **overlays** [overlies] the quartzite.
The choice **lays** [lies] between these extremes.

The hen lays the egg, and the egg lies where it has been laid. I am reminded of the story about the Boston terrier. A gentleman from the West said: "Lay down pup. Lay down. That's a good doggie. Lay down, I tell you." The dog was obdurate. A Harvard graduate overhead this, and remarked: "Excuse me, sir; you'll have to say, 'Lie down'; he's a Boston terrier."

The ore-reserve was worked up to a maximum in order to permit the **installation** of a smelter.

Here we have an example of the use not only of an unfitting word but of one that is ridiculous in its incongruity. To install is to place in a seat; a person is installed when he is placed with ceremony in an office of dignity. To use grandiose words, words so eloquent of dignity, in such a context is an abuse of language. The writer meant nothing more than the "building," "erection," or "construction" of a smelter.

This process will **inaugurate** the production of oil from shale in the Rocky Mountain region.

To "inaugurate" is to introduce a person to an important office with appropriate ceremony, or to initiate something of dignity or importance. It is a sonorous word befitting public affairs; it is not the word to use in a technical article, more particularly one that is of no consequence, as was the one from which I quote; a bishop is installed; a President is inaugurated. The simple word "start" covers the meaning in the above context. Unfortunately, the silliness of much of the pompous scribbling of newspaper reports is not recognized, otherwise ridicule would be the meed proper to such a statement as:

The Great Fake management proposes to inaugurate a vigorous campaign of development, and prosecute an extensive exploration, and then proceed to the installation of a large mill, in the confident anticipation of prolific dividends.

Such statements are common in mining papers. They are found elsewhere; for example:

Rachmaninoff's truly artistic playing, his wonderful interpretations, and his unique personality, all blended together in painting tone poems of infinite beauty, so eminent in color value that after striking the ear they progressed to the heart and nestled there.

The output has been maintained at a level not **pronounceably** [pronouncedly] below that of last year.

One can "pronounce" a thing good, as well as pronounce a word correctly, but when something is done decidedly or emphatically, we use "pronouncedly" to convey that meaning, as above.

The ore is **growing less rich** [becoming poorer] in depth.
The production has **grown less** [diminished] every year since then.

Growth connotes increase, the antithesis of shrinkage.

The economic geologist has been able to assist the miner **materially** in following his ore through the **vicissitudes** [vagaries] of folding and faulting **if** [where] the deposit was bedded or in sheet-form.

"Materially" has no meaning to fit this context; the use of it is a mere illiteracy. The writer means that the assistance has been considerable. "Vicissitudes" refers to changes of fortune; it does not fit natural phenomena; he might use "vagaries," which means capricious wanderings. I suggest:

"The economic geologist has been able to assist the miner in the effort to follow the ore amid the complexities of folding and faulting, particularly where it was in the form of beds or sheets."

The last phrase reminds me of the Australian engineers and his "cubicular" galena!

The equilibrium between the oil **in** [on] the surface and the oil in the **volume** [body] of the emulsion . .

The use of the wrong preposition indicates defective mental vision, and this inference is confirmed by the misuse of the word "volume." The contrast is between the surficial and the interior parts, between "on" and "in," between outside and inside.

In no other way can the cost of living be normal and an **equable** [equitable] division of the comforts of life be obtained for all.

The editor—for he was an editor—must have been thinking of the climate of California, where he lived. "Equable" means "not easily disturbed," "uniformly even," or "unvarying." "Equitable" means "fair" or "just"; and that is what he intended to say.

When we have a technical word for a specific purpose, we gain nothing by using another. For example:

This ore makes a most desirable **diet** [feed] for blast-furnaces.

Perhaps he was beguiled by apt alliteration's artful aid. In the zinc-mining district of Wisconsin they talk about "mill-diet." "Diet" means "a way of feeding" or a "prescribed course of food," not the food itself. "Feed" is a technical term signifying the ore and other materials that are put into a machine for metallurgic treatment.

Those who adopt the vernacular of the mining camp tear language from its literary moorings and set it adrift in the shoals of ignorance, thus:

When special accuracy was demanded in surveying underground, as in **locating** an **upraise** to **meet** a shaft . . .

A raise (or, better, "rise") is an upward opening in a mine; the idea of "up" is as implicit in "raise" as the idea of "down" in "sinking." "Locating" here means the establishing of the place where the raise is to be started; surveyors use the technical term "spotting" for this purpose, meaning the selecting of the spot at which to start. One can guess what is meant by "meeting" a shaft, but the precise word is "connect," which signifies the joining of two things. The engineer who made the statement as quoted is a scholarly gentleman, but he thought, I presume, that the use of such vulgarisms

would give local color or a touch of reality to his description of mining conditions. He might have said:

"When special accuracy was demanded in the surveying underground, as in pointing a raise to connect with a shaft . . . "

In order to **find** how much a body of ore will **pay**, it is first necessary to **find** what is the lowest grade of ore it will pay to work. Without first **finding** this, the value of an orebody can not be **found.**

He used the wrong word five times. The word "find" is used aptly when referring to the discovery of ore, but in this quotation it is unsuited to the context. The first "find" can be replaced usefully by "ascertain," the second by "determine," and the third by "estimate." The first "pay" is wrong; he means "yield." The second "pay" is colloquial. "First" is redundant. I suggest:

"To ascertain the total profit that can be won from a given orebody it is necessary to determine what is the lowest grade of ore that can be worked profitably; until this is done, the value of the orebody cannot be estimated."

The use of one wrong word leads naturally to the use of many that are equally ill chosen, for example:

Investors in Kimball's Kentuck and Kimball's Optimo Syndicates have had the **value** of their **earnings** doubled in just seven days.

Here we have an example of the purposeful misuse of words. Those who subscribe for the stock of an oil syndicate—that is, run the risk of allowing their money to be used by irresponsible promoters—are not investors; they are speculators; they may be gamblers. "Investment" and "investors" are words habitually misused by writers in the financial press.

He **invested** his savings in a Californian gold mine, and within two years won a competence for life.

Any mine that yields a person a fortune within the short period of two years is a gorgeous speculation, not an investment. If he put his savings into the mine recklessly, and without adequate information, he did not even speculate; he gambled. In the previous quotation the persons who profited temporarily from their plunge into an oil deal did not have "the *value* of their *earnings* doubled." The promoter who made the statement meant that his victims had doubled the amount of the money they risked; they did not "earn" anything, because their gain was not the reward of labor or of merit; nor did the "value" of their receipts increase, for "value" is the worth of a thing. Moreover, the value of their dividends was much less than they supposed, because the money that was returned to them was not interest on their capital, it was not a true dividend, but a part of the money they and others had subscribed; it was distributed among them for the purpose of deluding them into the belief that they were participating in a lucrative business, thereby prompting them to buy more stock at a fictitious price. Such terms as "investment," "dividend," and "ore" are key-words in the economics of mining, and the misuse of them is the stock-in-trade of unscrupulous promoters. To "invest" is to place money where it is safe, in the expectation of receiving interest on the principal; to "speculate" is to take the risk of losing money in the expectation of increasing the principal, rather than to look for a return in dividends; to "gamble" is to speculate recklessly, looking to luck rather than knowledge as the chief factor of success. A "dividend" is the periodic return on capital invested; until the capital has been redeemed one cannot know whether the periodic return of money from the profit of an enterprise be a dividend or only a return of part of the capital. "Ore" is metal-bearing rock that can be exploited at a profit at a given time and place; it is a term in mining economics, not in mineralogy or geology, and when used in these sciences it is without precise meaning, having reference to mineral that may possibly become ore if conditions favorable for exploitation supervene.

Since graduation from a leading engineering university, **which includes** a period of more than twelve years, I have been in the game of **self-location** of engineering positions. During this time I have **relocated** myself many times in various cities throughout the country.

This was the first paragraph of an article that was submitted to me for publication. It was returned as soon as the paragraph had been copied for the purpose to which I have put it here. The wording is so bad that the statement needs to be rewritten, but I have marked a few of the obvious blunders. The period to which he refers "covers," not "includes," the twelve years. To "include" is to comprise or embrace something that is necessarily smaller. If the time had been lengthened to more than twelve years, it would include twelve or any less number; it did not, for it covered just twelve years, and no more. The "university" did not include the period; the reference is to "Since graduation." The finding of a position for oneself is not a "game," unless it involve amusement or trickery. Incidentally, I may say that the use of the phrase "the mining game" for the business of mining is much to be deprecated, except when used by fakers and fraudulent promoters. A mining engineer should not refer to his own honorable profession as a "game," because it is neither a jest nor a diversion. "Self-location" is absurdly wrong as a word to express the obtaining of a professional appointment or position. This applies also to "relocated." A claim may be "relocated" when the time of the first location expires or the right to it otherwise lapses. When a man says that he intends to "locate" in Chicago, for example, he is using a vulgarism that is particularly objectionable among mining engineers, because they use the term "locate" to describe the technical operation of obtaining a preliminary right to exploit a piece of mineral land. What the writer probably meant to say was something like this: "Since my graduation from an engineering college—twelve years ago—I have been compelled to seek a position for myself several times and in many cities."

The Mary Malone Mining Co. has been **exploiting** its main vein at depth with a diamond drill.

"Exploitation" and "exploration" are words of distinctly different meaning, although newspaper reporters and other careless people seem to ignore the distinction. Sometimes, unfortunately, the typist and the compositor use one in place of the other, especially if indistinct handwriting leave the choice open to them. To "explore" is to examine or investigate; in mining it refers to various kinds of prospecting, as in the case cited by aid of the diamond-drill. To "exploit" is to turn to account, to work or utilize a thing for one's benefit. An ore deposit is first explored and then, if it justify the further effort, it is exploited for the benefit of the owner of the ground or of those to whom the owner has transferred his rights.

Turning to something more pleasant, let me cite an example of the fortunate effect of selecting the right word in an oratorical climax. The references that follow may be foreign to technical writing, but they will serve to illustrate the function of language in transmitting thought. The speaker was John Bright, a Quaker, a man simple and unaffected in all his ways, a political leader of acknowledged sincerity. He was addressing the House of Commons in 1855 on the subject of the Crimean War and the loss of life before Sebastopol. He said:

"An uneasy feeling exists as to the news which may arrive by the very next mail from the East. I do not suppose that your troops are to be beaten in actual conflict with the foe, or that they will be driven into the sea; but I am certain that many homes in England in which there now exists a fond hope that the distant one may return—many such homes may be rendered desolate when the next mail shall arrive. The *Angel of Death has been abroad throughout the land; you may almost hear the beating of his wings.* There is no one, as when the firstborn were slain of old, to sprinkle with blood the lintel and the two sideposts of the doors, that he may spare and pass on; he takes his victims from the castle of the noble, the mansion of the wealthy, and the cottage of the poor. It is in behalf of all these classes that I make this solemn appeal."

The effect was tremendous: "It seemed," says the chronicler, "that the House was hushed to listen for the beating of the wings." As Cobden said to Bright afterward, "You went very near that time. If you had said 'flapping' instead of 'beating' of the wings, the House would have laughed." To which Trevelyan adds: "But Bright could no more have said 'flapping' than Mr. Gladstone could have made a false quantity."[1] Another great speech—a greater speech—may be instanced. In Lincoln's Gettysburg address will be found numerous examples of the fitting word, of the one word that is appropriate to the sense. At the moment, the long and florid oration delivered by Everett had impressed the audience more than Lincoln's short and simple utterance. As an English biographer (Lord Charnwood) says: "The few words of Abraham Lincoln were such as perhaps sink deep, but left his audience unaware that a classic had been spoken which would endure with the English language." It will. Even in such a context as this I do not hesitate to quote the whole speech:

"Fourscore and seven years ago our fathers brought forth on this continent a new nation, conceived in liberty and dedicated to the proposition that all men are created equal. Now we are engaged in a great civil war, testing whether that nation, or any nation so conceived and so dedicated, can long endure. We are met on a great battlefield of that war. We have come to dedicate a portion of that field as a final resting-place of those who here gave their lives that that nation might live. It is altogether fitting and proper that we should do this. But, in a larger sense, we cannot dedicate—we cannot consecrate—we cannot hallow—this ground. The brave men, living and dead, who struggled here have consecrated it, far above our poor power to add or detract. The world will little note nor long remember what we say here, but it can never forget what they did here. It is for us the living, rather, to be dedicated here to the unfinished work which they who fought here have thus far so nobly advanced. It is rather for us to be here dedicated to the great task remaining before us—that from these honored dead we take increased devotion to that cause for which they gave the last full measure of devotion—that we here highly resolve that these dead shall not have died in vain—that this nation, under God, shall have a new birth of freedom—and that government of the people, by the people, for the people, shall not perish from the earth."

The key-words are "consecrate" and "dedicate," the "living" and the "dead." Behind the choice of the right words is the cause of the right choice, and that is sincerity, the sincerity that inspires all true art. Stephen Douglas could not have said what Lincoln said at Gettysburg, nor could Disraeli have spoken as Bright did. Without sincerity the words of a man are as sounding brass or tinkling cymbal.

[1] "The Life of John Bright," by George Macaulay Trevelyan, page 385.

U. S. Bureau of Mines Personnel

The personnel of the U. S. Bureau of Mines was recently published in a bulletin of that organization, as follows:

H. Foster Bain, Director.
E. A. Holbrook, Assistant Director.
F. J. Bailey, Assistant to Director.
H. E. Meyer, Chief Clerk.

DIVISION CHIEFS

Investigations Branch

G. S. Rice, Chief Mining Engineer.
O. P. Hood, Chief Mechanical Engineer.
R. B. Moore, Chief Chemist.
D. A. Lyon, Chief Metallurgist and Supervisor of Stations.
A. W. Ambrose, Chief Petroleum Technologist.
R. R. Sayers, Chief Surgeon.
C. E. Munroe, Chief Explosives Chemist.
H. S. Mulliken, Special Assistant to the Director.

Operations Branch

T. T. Read, Chief, Information Service.
G. S. Pope, Chief Engineer, Government Fuel Yards.
D. J. Parker, Chief Engineer, Mine Safety Service.

DIVISION OF EXPERIMENT STATIONS

D. A. Lyon, Supervisor of Stations.

H. H. Hill, Superintendent, Petroleum Station, Bartlesville, Okla.

O. C. Ralston, Superintendent, Pacific Station, Berkeley, Cal.

W. R. Crane, Superintendent, Southern Station, Birmingham-Tuscaloosa, Ala.

R. T. Stull, Superintendent, Ceramic Station, Columbus, Ohio.

J. A. Davis, Superintendent, Alaska Station, Fairbanks, Alaska.

C. E. Julihn, Superintendent, North Central Station, Minneapolis, Minn.

A. C. Fieldner, Superintendent, Pittsburgh Station, Pittsburgh, Pa.

S. C. Lind, Superintendent, Rare and Precious Metals Station, Reno, Nev.

——— ———, Superintendent, Mississippi Valley Station, St. Louis-Rolla, Mo.

Thomas Varley, Superintendent, Intermountain Station, Salt Lake City, Utah.

C. E. Williams, Superintendent, Northwest Station, Seattle, Wash.

C. E. van Barneveld, Superintendent, Southwest Station, Tucson, Arizona.

J. J. Rutledge, Superintendent, Central District Station, Urbana, Ill.

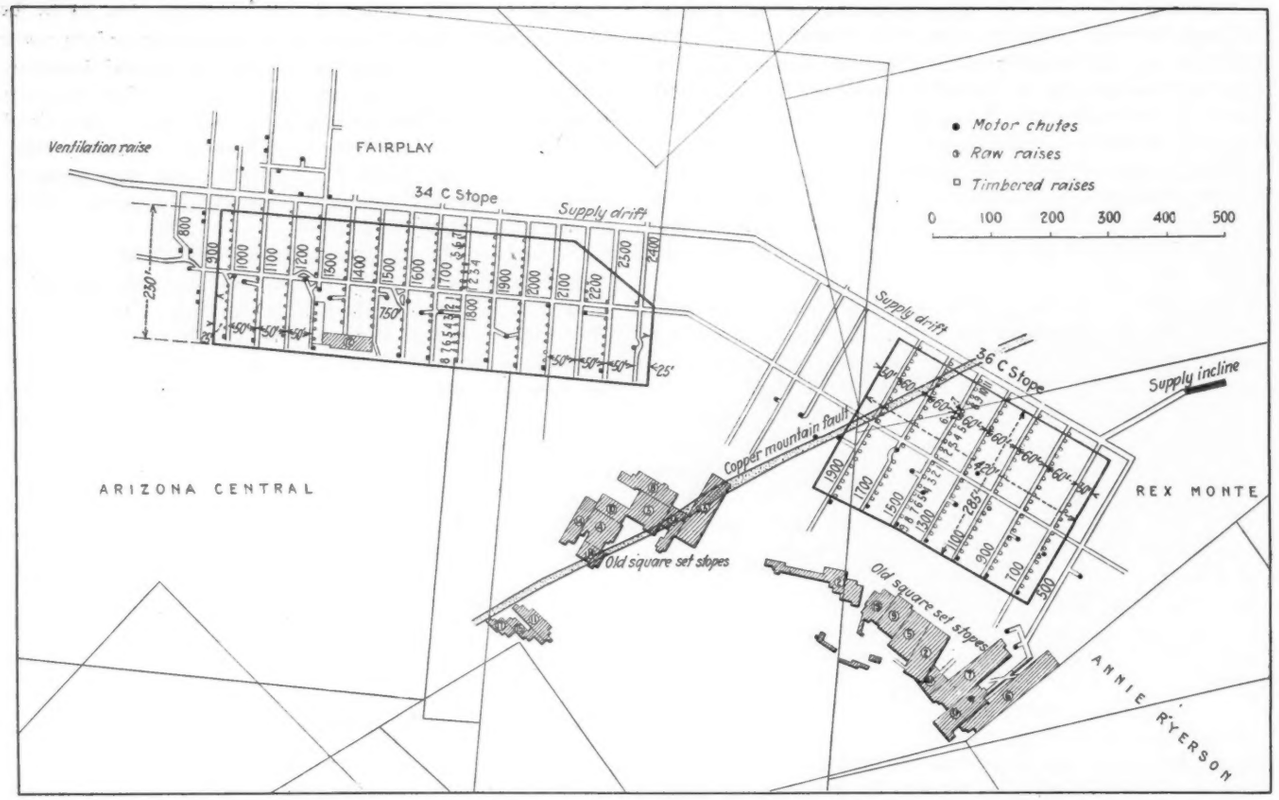


Fig. 1. Plan of Nos. 34 and 36 incline slice stopes, Humboldt mine, Morenci, Ariz.

The Incline Slicing Method as Applied to Large Orebodies

Tons Per Man Increased Over Figures Obtained by Flat Slicing System and Costs Show Decrease of 15 Per Cent in Favor of Incline Method of Stoping—Mexican Labor Employed and Bonus System in Force

BY JOSEPH P. HODGSON AND JOHN KIDDIE

THE ADAPTABILITY of the incline slicing system to large blocks of ore has been questioned in an article written by J. Parke Channing, appearing in *Mining and Metallurgy* for January, 1922, so that it is opportune to describe briefly the progress which has been made by the adoption of the method in the mines of the Morenci, Ariz., district. The general scheme of preparatory work and the method of operation of incline slicing at the Coronado mine, in stoping a long and comparatively narrow vein, has been previously described.[1]

Owing chiefly to the satisfactory results obtained at Coronado, the incline slice was introduced in the Humboldt mine, at Morenci, in 1918. Subsequently, several flat slicing stopes have been changed to the incline system. This method of mining has yielded the following tonnages:

Year	Tons from Incline Slicing	Per Cent of Total Humboldt Tonnage
1918	62,394	11
1919	154,694	21
1920	200,888	27
1921	153,635	36

[1]P. B. Scotland, *Engineering and Mining Journal*, April 7, 1917, and W. G. Scott, *Transactions* A. I. M. E., Vol. 59.

The percentage of ore mined by the flat slice system has decreased during the same period, from 76 per cent of the total in 1917 to 24 per cent in 1921.

The incline slice method was first tried out in stope No. 36, in a block of ground extending 55 ft. in height above the Humboldt adit level. This stope had been previously mined down from the capping, for a distance of 44 ft., by brow caving, on two floors; and below this, by flat slicing for 55 ft., by five slices each 11 ft. in height. The incline slices were started under this flat mat, and have been continued, until at present a maximum vertical distance of 77 ft. has been removed by this method.

To show the comparative efficiency obtained in this stope by the flat vs. the incline system, we give below yearly figures for two years preceding the change and for the first two years of the incline method after the change:

Year	Method	Dry Tons	Tons per Stoping Man
1916	Flat slicing	90,684	5.4
1917	Flat slicing	123,980	5.4
1918	Incline slicing	62,394	6.4
1919	Incline slicing	154,694	8.8

The tonnages shown for the first two years include all ore from flat slicing in the stope, whereas the figures

for the last two years represent ore from incline slicing only, and exclude the diminishing tonnage from flat slicing. All the labor employed in this stope, below the grade of shift boss, was Mexican. In the tons-per-man figure is included timbermen and helpers, miners, muckers, and hand trammers.

Fig. 1 shows a plan, on the —55-ft. level, of the two largest incline slicing stopes of the Humboldt mine. These stopes are respectively 230 x 750 ft. and 285 x 420 ft. in area. The preparatory work in No. 34 stope consists of blocking out the area to be stoped by parallel raw drifts spaced at 50-ft. centers. Each drift has a timbered raise at its extreme east end, 55 ft. in height, and raw raises at 15-ft. intervals, 44 ft. high, for its entire length. One extra finishing raise, also raw, is placed to the west of the stope, outside the actual stoping area. A large haulage drift for supplies, to the west of the stope, is connected to each of the cross drifts. The incline slices begin at the east side of the stope, as shown, and are carried back over each drift, with the raises forming the center line of the slice. The over-all width of these slices is 50 ft. By this method of blocking out, approximately fifty-three tons of ore is stoped per foot of preparatory work.

In No. 36 stope the drifts were driven with 60-ft. centers to conform to the work already done on the adit level, 55 ft. above. In other respects the blocking out is similar to that just described. By this arrangement, sixty-five tons are stoped for each foot of preparatory work.

Modification in Method of Stope Preparation

In the stopes described, the slices were taken across the orebody, making their total lengths 230 ft. and 285 ft. respectively. It was necessary to lay out the areas as indicated, on account of the stoping already in progress on the adit level, as a continuous production of ore had to be maintained during the period of change. Had no previous work been done in the orebody, it would have been feasible to run the slices parallel to the long axis of the ore, making them 750 ft. and 420 ft. respectively. This latter system would necessitate laying out the stoping drifts 50 ft. apart for the full lengths of the orebodies; for handling supplies and men, it would be necessary to drive several cross drifts. Inasmuch as the time of maximum trouble and minimum production from any particular slice is during the starting period, there are distinct advantages in making the slices as long as possible.

Figs. 2 and 3 show the method of stoping, which is similar to that described in previous articles, differing only in some of the details. The present modification

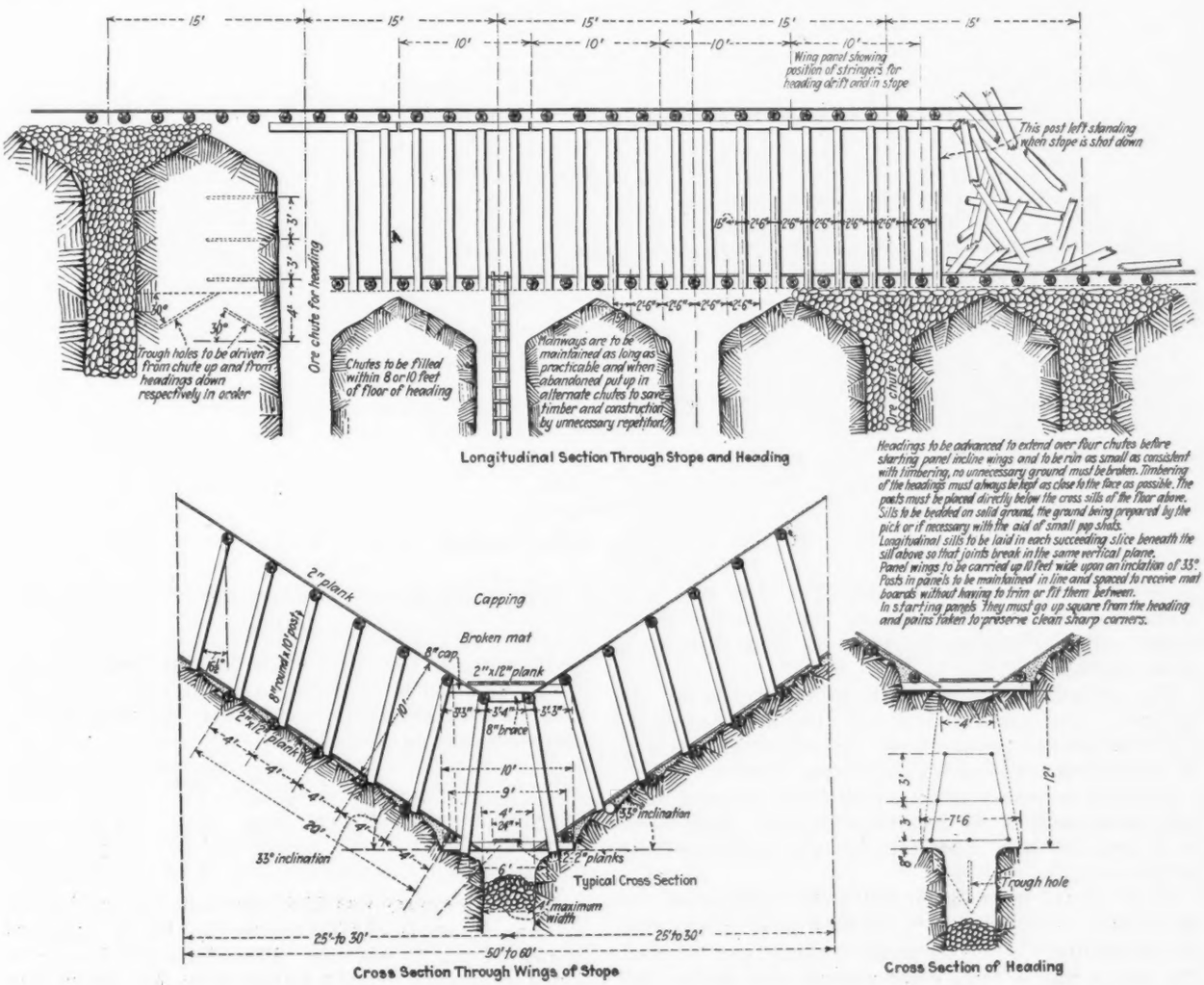

Wing panel showing position of stringers for heading drift and in stope
This post left standing when stope is shot down
Trough holes to be driven from chute up and from headings down respectively in order
Ore chute for heading
Chutes to be filled within 8 or 10 feet of floor of heading
Hanways are to be maintained as long as practicable and when abandoned put up in alternate chutes to save timber and construction by unnecessary repetition
Longitudinal Section Through Stope and Heading
Headings to be advanced to extend over four chutes before starting panel incline wings and to be run as small as consistent with timbering, no unnecessary ground must be broken. Timbering of the headings must always be kept as close to the face as possible. The posts must be placed directly below the cross sills of the floor above. Sills to be bedded on solid ground, the ground being prepared by the pick or if necessary with the aid of small pop shots.
Longitudinal sills to be laid in each succeeding slice beneath the sill above so that joints break in the same vertical plane.
Panel wings to be carried up 10 feet wide upon an inclination of 33°.
Posts in panels to be maintained in line and spaced to receive mat boards without having to trim or fit them between.
In starting panels they must go up square from the heading and pains taken to preserve clean sharp corners.
2"plank
Capping
Broken mat
8"cap
2"x12"plank
8"rounds,10'posts
8"brace
33° inclination
Typical Cross Section
4' maximum width
25'to 30'
50'to 60'
Cross Section Through Wings of Stope
Trough hole
Cross Section of Heading

Fig. 2. Cross-sections showing incline slicing method, Morenci, Ariz.

has been developed to facilitate the shooting down of sections as the panels, or wings, are completed. In this way the mining of the wings can be done by bonus or contract system, rather than by day's pay. It has been found that stopes of 50-ft. width have an advantage over those of 60-ft., as the ventilation at the extreme top of the wings in the 60-ft. slices is not as good and interferes with the efficiency of the workmen. In the stopes shown in Fig. 1, the ore is hand-trammed in one-ton cars on the sublevel to motor chutes. In No. 34 stope one motor chute is situated between each two drifts. In No. 36 stope a separate motor chute serves each drift. The possibility of eliminating the hand-tramming should be considered, particularly in ore-bodies which are continuous from the stope floor to the main haulage drift.

The chief difficulty encountered in stoping by the incline method has resulted from the presence of old motor tunnels on the adit level. These tunnels are large in cross section, and as the slices come down to the level it becomes necessary either to fill them by hand or to hold them open, as the conditions require. Both operations are not only expensive but also interfere with production.

Prior to the time when the stope approached the adit level, it was possible to install a gang bonus, with results mutually beneficial to the company and the men. The bonus was in force eight months, and during that time an average of 10.6 tons per stoping man was obtained, covering a total extraction of 94,000 tons of ore.

A comparison of the timber consumption for both incline and flat slicing is as follows:

	Board Feet of Lumber per Ton
All incline slicing for four years (1918 to 1921 inclusive)	9.0
All flat slicing for seven years (1915 to 1921 inclusive)	7.9

The comparison of costs between the incline slice method and the flat slice system shows a reduction of 15 per cent in favor of the incline method for the four years under review, and proves that the application of the incline slice in these properties, to large ore areas, has been successful.

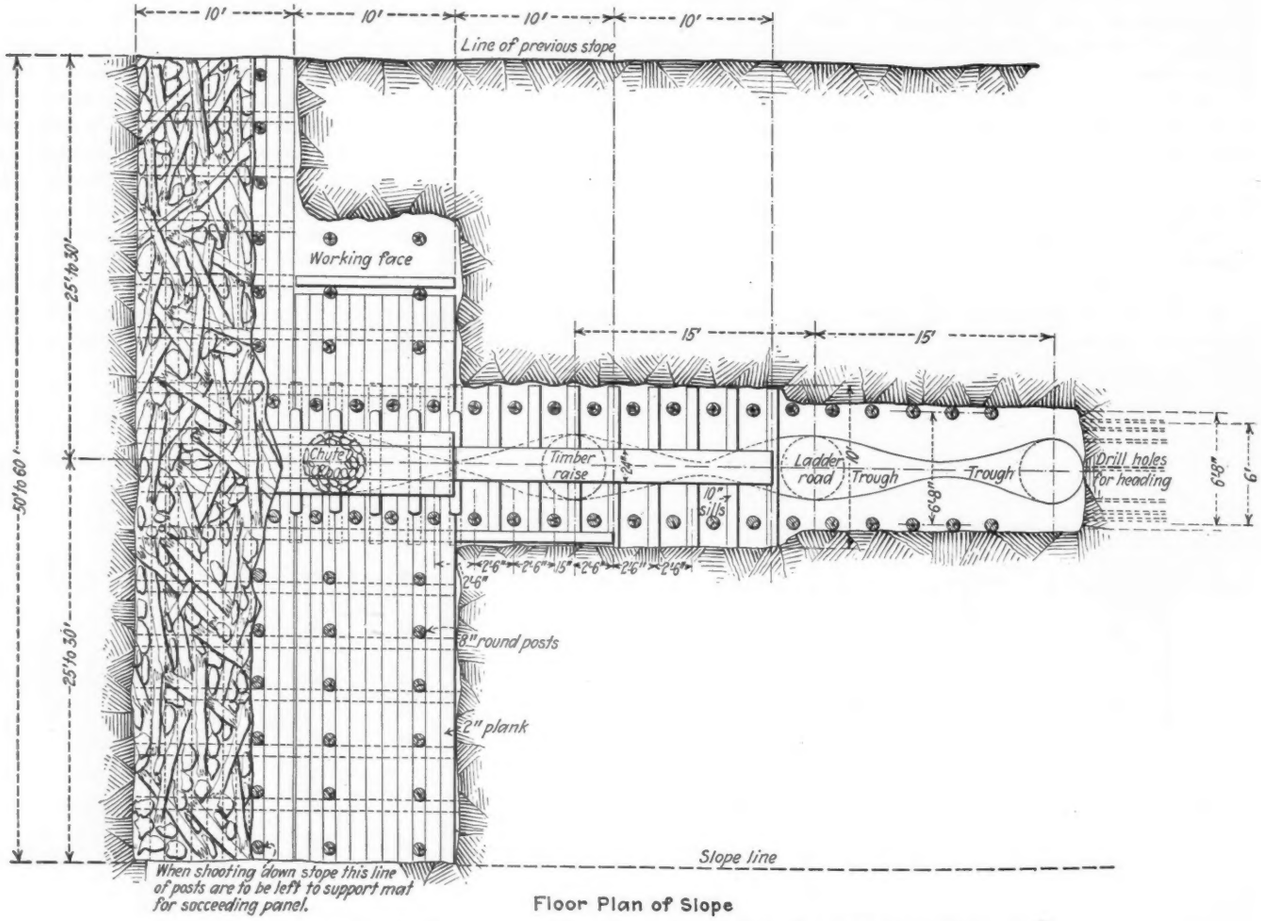


Fig. 3. Plan showing incline slicing method, Morenci, Ariz.

Magma Copper Co. Recovers 94 Per Cent in Milling

According to the report of the Magma Copper Co. for 1921, operating at Superior, Ariz., the ore mined and milled during the three months that the plant was in operation was as follows:

	Dry Tons	Per Cent Copper	Ounces Silver	Ounces Gold
Total ore mined	21,445	5.25	3.15	0.038
Hand-sorted ore shipped direct to smelter	2,238	16.45	7.74	0.090
Mill feed	19,207	3.94	2.61	0.032
Mill concentrates	6,130	11.60	7.44	0.100
Mill tailings	.....	0.357	0.351	Trace

The mill recovery was 93.83 per cent. At present the mill has a capacity of 300 tons per day, but it is planned to enlarge this to 600 tons. Plans have also been completed by Bradley, Bruff & Labarthe for the construction of a smelter, and it is expected to construct a standard-gage railroad to Magma Junction with maximum grades of 2 per cent into Superior and no adverse grades out.

Why the Mines of Asia Minor Are Not Worked

Many Difficulties To Be Overcome—Foreigners Kept from Acquiring Property Roads Bad and Forests Destroyed—Labor Conditions Difficult

By P. A. Georgiades

ASIA MINOR is a country with a great future from both the agricultural and the mining points of view. It is estimated that if all the non-productive land were taken out, there would still remain 75,000,000 to 80,000,000 hectares of first-class productive land, which could supply food to more than 100,000,000 inhabitants. The mineral wealth is also great. In recent years many deposits of minerals have been discovered, and active prospecting has been carried on in the various vilayets (districts). During the World War, numerous German and Austrian scientific missions visited the country to determine the importance of the deposits. Mining of coal, chromium, emery, boracite, and meerschaum was carried on seriously before the war, but since the Armistice little work has been done. Little has likewise been done toward exploitation of the copper, iron and zinc mines.

The difficulties encountered in the exploitation of mining properties in Turkey are numerous. The principal ones have to do with the mining law, the absence of roads, the destruction of forests, labor and the conditions of work, and the selling of mines.

The mining industry was greatly handicapped by the mining law up to 1861, but conditions were improved slightly by the law of 1869, which was based on the French law of 1810. According to this law, the right of priority was conceded to the discoverer of the mine. The royalty was reduced to 5 per cent, and the concession was not to exceed ninety-nine years. In 1887, a new law gave to the mining industries further facilities, but the law of 1906 (which is still in force with some alterations) brought with it new difficulties.

It is the Turkish policy to keep mining property from passing into the hands of foreigners. For this reason foreigners often associate themselves with an Ottoman subject, who ostensibly becomes proprietor. If, however, this Ottoman subject is a Christian, he encounters so many difficulties that he finally thinks the affair is impossible and retires, thus leaving his place to a non-Christian Ottoman subject, who readily gets the concession.

Anatolia is characterized by the poorest of roads, few of which can be called roads at all. In certain vilayets there are only paths, or trails, which, after a rain, become virtually impassable. The railroads also are not sufficient to provide means of communication, and are entirely lacking in many of the provinces. Generally speaking, all goods have to be transported either by buffalo carts or on camel back. This is the only mode of transportation, and it is so expensive that much of the country's raw materials cannot be utilized. Transportation fees are also so high that establishment of factories in the interior is impracticable.

The forests of the country have been cut down and destroyed without realization of the necessity of replanting the trees. Furthermore, the rain has carried away all soil from these cut forests, so that the rock is laid bare and there is no possibility of reforestation. Except in the provinces of Trebizond and Erzeroum, the timber resources of Turkey are greatly reduced, if not completely exhausted. For example, twenty to twenty-five years ago it was possible to find within 15 km. the wood necessary for timbering the Arghana copper mines, and also for making charcoal, much used at that time for smelting the ore. Today one must go more than 50 km. to find it. The destruction of the forests is in many districts the greatest drawback to the development of the mining industry.

Suitable laborers for working the mines are not easily secured and retained. The real Turk works slowly. Under the most favorable conditions, when he gives his maximum work, his output, compared with that of a European workman working under similar circumstances, is about one-third of the latter's. Turkish labor, moreover, is not dependable, for the reason that the workmen are both miners and agriculturists. During the rainy season they work in the mines and when it is time to go to the fields they suddenly leave the mines to look after the planting. Unless there is a foreign element, such as Armenians or Greeks, employed in the mines, the work closes until the rainy season comes again. The Turkish workman lacks education and training. Rapidity of work and economy of time due to the use of improved methods and machinery are altogether unknown to him. The old saying "time is money" has no significance in Asiatic Turkey.

As mentioned, the work in the mines is carried on in the most primitive manner, with the exception of the operations for coal at Zongouldak and those for silver and lead at Balia. In these places, compressed air and electricity are both utilized. Again, some of the mines are given to the villages in the vicinity for exploitation. In such instances the mining is done by the inhabitants, who, owing to lack of capital, cannot purchase machinery and employ a mining engineer. The result is that they produce little and sometimes they actually destroy the mines.

It frequently happens that men without any capital at all ask and obtain the so-called *permis des recherches* (claim), for six months, this period being afterward extended to two years. If during this period it is proved that the mine is of value, the man who has a *permis des recherches* applies for a concession or firman (imperial irade or order). The concession is given usually for a period not exceeding ninety-nine years.

A man with such a claim considers that he owns the mine and is already in possession of a fortune. If the property is of value, he will propose, if approached, that he be furnished the capital to operate it, and in return he will allow a small percent of the net proceeds. He never by any chance offers to sell or lease the mine, or even to become associated in the work of development. Generally it is difficult to treat with those who are in possession of such a firman, although many of them live in poverty.

Cost of Milling and Treating Ores*

Data from Various Sources Show Wide Variations, but, Knowing Location and Character of Plant, It Is Possible To Arrive at General Conclusions

THE COSTS given in the following tables have been collected from a variety of sources, such as company reports, technical articles, hand-books, manufacturers' catalogs, and private information. Usually, the method of estimating the costs of the various operations and the distribution of overhead expense differs considerably; so that unless all details are known and comparable, sound judgment must be used in applying the figures. The only safe method of estimating milling costs for proposed plants or processes is to furnish to competent engineers all the facts available, and let them make an estimate. In plants of the same type, the factor affecting the wide variation in costs per ton is the capacity of the plant, greater economies being possible in a large plant than in a small one.

Recent figures show increased costs because of the World War; it is believed that costs for the period 1912 to 1916 will be of as much value as those for the period 1917 to 1920 and that actual costs will be found midway between these two for the period ahead of us.

Tables of itemized costs are given, together with tables indicating the results of operations of individual plants. Total costs may be obtained by aggregating the individual items, using the tables of total costs for the purpose of checking and for estimating the effect of variables, such as freight, transportation, power, labor, and climate.

The value of metal extracted from the ore is believed to have some bearing upon the amount that may be expended on a plant to treat the ore; for that reason the production has been calculated in value of metal extracted rather than in assays of mill feed. In some operations this figure is approximate; it is intended to be used only for its bearing upon the cost, however variable that may be. In mills treating gold and silver ores, a study of the question indicated that more consistent costs were obtained by a classification according to climatic conditions:

Desert Conditions involve high costs for power, water, and transportation, with unfavorable labor, living, and climatic conditions, or most of these.

Average Conditions indicate that not more than two of the unfavorable factors mentioned under desert conditions are present, the remainder being normal or favorable.

Crushing Costs

It has been found desirable to classify the operations as follows:

Breaking (preliminary crushing, coarse crushing) is the first operation and is done in gyratory or jaw breakers or crushers. Costs depend more upon the character of the ore, the cost of power, and the load factor of the crushing unit than upon the relative capacity of the plant, according to most reported costs.

Stamps, Chilean mills and ball mills are occasionally used for the combined operations of secondary crushing and grinding, at a cost about equal to the sum of the two incomplete costs given on page 920.

*Abstracted from a metallurgical bulletin (copyrighted) compiled by the technical staff and published by permission of the General Engineering Co., of Salt Lake City, Utah, and 120 Broadway, New York.

CONCENTRATING COSTS

By vanners and tables in stamp mills, after amalgamation, per ton of mill feed	$0.04 to $0.15
By jigs, tables and vanners on lead and copper ores, per ton of mill feed	0.20 to 0.40
By tables after flotation, per ton of mill feed	0.05 to 0.10
By flotation, per ton of mill feed	0.06 to 0.30

CYANIDATION COSTS

Exclusive of Crushing

	Per Ton Milled
Leaching	$0.15 to $1.25
Sliming, silver ore	1.00 to 2.00
Sliming, gold ore	0.50 to 1.00

DETAIL COSTS

Chemicals, gold ore	$0.25 to $0.60
Chemicals, silver ore	0.75 to 1.25
Classifying	0.02 to 0.05
Agitation	0.05 to 0.10
Filtering	0.05 to 0.15
Clarifying, precipitating, and refining	0.15 to 0.50
	Per Ton
Roasting ores and concentrates	$0.65 to $1.25

LEACHING COPPER ORE

	Per Ton
Tailing, with sulphuric acid, precipitated on scrap iron, 1914, 2,000 tons daily	$0.70
Oxidized ores, with sulphuric acid, 1918, 1,200 tons daily	1.06

DREDGING

	Cents
River bottom carrying an average of 8.66c. per cu.yd., 1919 5,000 cu.yd. per day, cost per yd.	6.41

MISCELLANEOUS

	Per Ton Milled
Water	$0.01 to $0.25
General expense, including superintendence and assaying	
Small plant	About 0.75
Large plant	About 0.10

POWER COSTS

STEAM POWER

	Costs per Horsepower per Twenty-four Hours
Non-condensing engines, coal at $7 per ton	$0.20 to $0.22
Condensing engines	0.17 to 0.19
Compound condensing engines	0.14 to 0.17

For each variation of $1 per ton in the cost of coal, costs per horsepower should be varied: 1½c. for non-condensing engines, 1¼c. for condensing engines, and 1c. for compound condensing engines. A rough general figure for power costs in mining camps is $0.30 per horsepower per twenty-four hours.

ELECTRIC POWER

Charges for electric power are usually based on a variety of factors, in which the total power consumed and maximum demand have most influence in determining the rate. The following rate comparison is based on reported costs of power in milling plants:

Per Horsepower-Year	Per Horsepower-Month	Per Kilowatt-Hour, Cents	Conditions
$150	$12.50	2.0	Desert and unfavorable
120	10.00	1.6	Desert and unfavorable
90	7.50	1.2	Desert and unfavorable
75	6.25	1.0	Average
60	5.00	0.8	Average
45	3.75	0.6	Favorable
30	2.50	0.4	Favorable

The above figures are for 360 days of twenty-four hours, per year, and an average motor efficiency of 85 to 88 per cent.

ERECTION COSTS

MILLING PLANTS

	Cost per Ton per Twenty-four Hours
Coarse concentration, no flotation	$300 to $450
Gravity concentration and flotation	800 to 1,200
All flotation	600 to 800
Cyanide, all slime, stamps or ball mills, tube mills, filtering or counter-current decantation	1,000 to 1,400
Stamps with vanners	475 to 550

An empirical figure for the erection and installation of ore mills and similar reduction plants is $1.25 to $1.50 for each $1 spent for machinery, f.o.b. factory.

Under ordinary conditions, as in mining camps, the cost of mill buildings may be estinated as follows in per cubic foot of volume:

	Cents
Wooden buildings	3 to 6
Steel buildings	7 to 10
Erecting mill and smelter buildings:	
Wood	$30 to $40 per 1,000 ft.
Steel	0.75 to 1.5c. per lb.

Erection of sectionalized machinery will cost twice or three times that required for standard equipment.

FLOTATION-CONCENTRATION MILLS

Tons per Twenty-Four Hours	Locality	Value Extraction per Ton	Extraction per Cent	Details of Treatment	Cost per Ton	Per Cent Through 200 Mesh	Date	Product and Remarks
125	New York	....	..	Crushers, ball mills, flotation	$1.31	..	1919	.....
200	Arizona	$19.00	93	Crushers, ball mills, table concentration, flotation	0.87	45	1916	.....
1,100	Montana	19.00	..	Crushers, rolls, tube mills, table concentration, flotation	2.75	..	1919	Zinc
5,000	Arizona	9.00	78	Crushers, rolls, ball mills, table concentration, flotation	0.73	60	1918	Copper
5,000	Arizona	5.80	..	Crushers, rolls, ball mills, table concentration, flotation	1.01	..	1919	Copper
10,000	New Mexico	7.00	..	Crushers, rolls, ball mills, table concentration, flotation	1.37	..	1918	Copper
12,000	Nevada	6.40	68	Crushers, rolls, ball mills, table concentration, flotation	0.93	..	1918	Copper
12,000	Utah	5.00	..	Crushers, rolls, ball mills, table concentration, flotation	0.93	..	1918	Copper
15,000	Arizona	5.66	75	Crushers, disk crushers, ball mills, flotation	0.53	60	1916	Copper

GRAVITY-CONCENTRATION MILLS

125	Utah	....	..	.....	$1.44		1912	.....
150	Utah	....	..	.....	1.09		1917	.....
200	Utah	....	..	Sorting, crushers, rolls, gravity concentration	0.58		1912	.....
300–400	Missouri	....	..	Crushers, rolls, jigs	0.41		1913	Zinc
400	Colorado	$6.50	..	Crushers, stamp mill, tube mills, gravity concentration	2.08		....	Concentrate, cyanided
500	Missouri	....	..	Crushers, rolls, jigs, table concentration	0.97		1912	.....
500	Idaho	....	..	.....	0.55		1919	.....
1,000	Idaho	11.00	91	Crushers, rolls, jigs, table concentration	0.37		1908	Lead-silver
1,000	Idaho	17.00	..	Crushers, rolls, jigs, table concentration	0.72		1918	Lead-silver
1,250	Idaho	....	..	Crushers, rolls, jigs, table concentration	0.36		1911	Lead-silver
1,250	Missouri	....	..	Crushers, rolls, jigs, table concentration	0.36		1912	Lead
2,500	Missouri	....	..	Crushers, rolls, jigs, table concentration	0.34		1913	Lead
3,300	Arizona	4.80	70	Crushers, rolls, Chilean mills, table concentration, vanners	0.57		1912	Copper, disseminated
4,500	New Mexico	3.40	70	Crushers, rolls, table concentration, vanners	0.50		1912	Copper, disseminated
6,500	Arizona	3.15	67	Crushers, rolls, table concentration, vanners	0.45		1913	Copper, disseminated
8,000	Nevada	....	..	Crushers, rolls, table concentration, vanners	0.49		1912	Copper, disseminated
21,000	Utah	2.30	66	Crushers, rolls, table concentration, vanners	0.31		1913	Copper, disseminated
1,000	Michigan	2 to 4	70–80	Crushers, steam stamps, jigs, table concentration	0.27-.30		1908	Copper, amygdaloid
2,000	Michigan	2 to 4½	70–80	Crushers, steam stamps, jigs, table concentration	0.24-.30		1908	Copper, amygdaloid
4,000	Michigan	1¼ to 3½	70–80	Crushers, steam stamps, jigs, table concentration	0.17-.40		1908	Copper, amygdaloid and conglomerate

SILVER MILLS—ALL-SLIME CYANIDATION

AVERAGE CONDITIONS

180	Canada	$30.00	90	Milling	$2–$3	..	1913	Costs only approximate
250	Canada	....	92	Crushers, stamp mill, tube mills, cyanidation	2.95	28	1913	.....
350	Canada	10.25	95	Crushers, stamp mill, tube mills, cyanidation	2.10	..	1913	.....
450	Mexico	....	..	Crushers, stamp mill, gravity concentration, tube mills, cyanidation	2.64	..	1918	.....
500	Canada	....	..	Crushers, ball mills, tube mills, cyanidation	2.64	..	1919	.....
100	Nevada	15.30	90	Crushers, stamp mill, tube mills, gravity concentration, cyanidation	3.29	90	1913	.....
110	Nevada	13.00	94	Crushers, stamp mill, tube mills, gravity concentration, cyanidation	3.54	..	1913	.....
130	Nevada	19.00	92	Crushers, stamp mill, tube mills, gravity concentration, cyanidation	2.62	..	1913	.....
135	Nevada	16.00	93	Crushers, stamp mill, Chilean mills, tube mills, cyanidation	2.75	69	1914	.....
175	Nevada	....	..	Milling	3.80	..	1912	.....
250	Mexico	11.00	93	Crushers, stamp mill, tube mills, gravity concentration, cyanidation	3.86	..	1913	.....
400	Nevada	....	..	Milling	2.90	..	1912	.....
500	Nevada	16.30	90	Crushers, stamp mill, tube mills, gravity concentration, cyanidation	2.67	..	1913	.....
500	Nevada	16.00	..	Crushers, stamp mill, tube mills, gravity concentration, cyanidation	2.57	..	1914	.....
500	Nevada	24.00	94	Crushers, stamp mill, tube mills, gravity concentration, cyanidation	2.05	80	1914	.....

GOLD MILLS — ROASTING-CYANIDATION

100	Washington	$8.00	91	Crushers, rolls, roasting, tube mills, cyanidation	$2.00	..	1913	.....
550	Utah	....	..	Crushers, rolls, roasting, tube mills, cyanidation	1.10	..	'11–'12	33 per cent roasted
600	West Australia	5.00	..	Crushers, rolls, roasting, tube mills, cyanidation	2.29	..	1913	.....
700	West Australia	9.50	85	Crushers, stamp mill, grinding pans, gravity concentration, roasting, cyanidation	2.08	..	1912	Concentrate only roasted

GOLD MILLS—AMALGAMATION-CONCENTRATION

30	California	$3.00	..	Crushers, stamp mill, amalgamation	$1.92 (*a*)	..	1912	Followed by cyanidation
50	California	13.50	90	Crushers, stamp mill, amalgamation, gravity concentration	1.07	..	1913	.....
200	Korea	....	..	Crushers, stamp mill, gravity concentration, amalgamation	0.67 (*a*)	..	1914	Followed by cyanidation
300	California	....	..	Crushers, stamp mill, amalgamation	0.22 (*a*)	..	1913	Followed by cyanidation
1,000	Alaska	....	..	Crushers, stamp mill, gravity concentration, amalgamation	0.24	..	1912	.....
1,300	Transvaal	....	..	Crushers, stamp mill, amalgamation	0.27 (*a*)	..	1913	Followed by cyanidation
2,500	Alaska	2.50	92	Crushers, stamp mill, amalgamation, gravity concentration	0.185	..	1912	.....
4,000	South Dakota	....	..	Crushers, stamp mill, amalgamation	0.28 (*a*)	..	1914	Followed by cyanidation
7,000	Alaska	1.05	82	Crushers, rolls, tube mills, gravity concentration	0.24	35	1917	No amalgamation

(*a*) These are incomplete costs, as extraction is continued in cyanide operations that follow.

GOLD MILLS — CYANIDATION

AVERAGE CONDITIONS

85	California	$14.00	95	Crushers, stamp mill, tube mills, cyanidation	$1.73	..	1912	.....
115	Montana	11.55	..	Crushers, tube mills, cyanidation	2.00	..	1918	Sand leaching
150	Colorado	....	..	Milling	1.90	..	1912	.....
200	Korea	6.50	92	Crushers, stamp mill, tube mills, cyanidation	1.01	..	1914	.....
200	Central America	7.00	..	Milling	1.50	..	1910	.....
250	Colorado	26.00	94	Crushers, stamp mill, tube mills, gravity concentration, cyanidation	1.80	..	1908	.....
250	New Zealand	....	..	Crushers, stamp mill, tube mills, gravity concentration, cyanidation	1.52	..	1915	.....
300	California	....	..	Crushers, stamp mill, amalgamation, tube mills, gravity concentration, cyanidation	0.79	..	1913	.....
300	California	11.00	97	Crushers, stamp mill, gravity concentration, tube mills, cyanidation	0.98	..	1912	.....
350	Canada	20.50	95	Crushers, stamp mill, tube mills, gravity concentration, cyanidation	1.49	..	1913	.....
400	Colorado	2.25	75	Crushers, rolls, tube mills, gravity concentration, cyanidation	1.31	..	1913	.....
400	California	9.35	..	Crushers, stamp mill, amalgamation, tube mills, gravity concentration, cyanidation	1.07	..	1917	.....
500	Colorado	6.50	93	Crushers, stamp mill, amalgamation, tube mills, gravity concentration, cyanidation	1.38	74	1913	.....
500	Transvaal	6.25	..	Crushers, stamp mill, tube mills, cyanidation	0.96	60	1913	.....
500	Transvaal	11.25	..	Crushers, stamp mill, tube mills, cyanidation	1.09	60	1913	.....
600	Canada	13.00	..	Crushers, stamp mill, tube mills, cyanidation	1.24	..	1914	.....
700	India	17.00	85	Crushers, stamp mill, tube mills, cyanidation	0.86	..	1907	.....
875	Transvaal	4.70	..	Crushers, stamp mill, tube mills, cyanidation	0.87	60	1913	.....
1,000	Transvaal	4.50	..	Crushers, stamp mill, tube mills, cyanidation	0.91	60	1913	.....
1,100	Transvaal	....	93	Crushers, stamp mill, tube mills, cyanidation	0.82	62	1913	Sands treated separately
1,350	Transvaal	6.20	..	Crushers, stamp mill, tube mills, cyanidation	0.85	60	1913	.....
1,400	Transvaal	10.00	..	Crushers, stamp mill, amalgamation, tube mills, cyanidation	0.84	..	1918	.....
1,500	Transvaal	....	93	Crushers, stamp mill, tube mills, cyanidation	0.69	60	1913	.....
2,000	Transvaal	4.00	..	Crushers, stamp mill, tube mills, cyanidation	0.85	60	1913	.....
2,000	Transvaal	9.70	..	Crushers, stamp mill, tube mills, cyanidation	1.22	..	1919	.....
2,500	Transvaal	8.70	..	Crushers, stamp mill, tube mills, cyanidation	1.02	..	1917	.....
4,000	South Dakota	3.4	..	Crushers, stamp mill, amalgamation, tube mills, cyanidation	0.79	30	1914	Sands treated separately

Tons per Twenty-Four Hours	Locality	Value Extraction per Ton	Extraction per Cent	Details of Treatment	Cost per Ton	Per Cent Through 200 Mesh	Date	Products and Remarks
				DESERT CONDITIONS				
70	California	$5.70	95	Crushers, stamp mill, amalgamation, cyanidation	$4.02	..	1912	30 tons stamped; remainder rejected
100	South Africa	11.00	93	Crushers, stamp mill, Chilean mills, grinding pans, cyanidation	2.05	..	'12–'13	.....
150	Arizona	20.00	95	Crushers, stamp mill, tube mills, cyanidation	2.50	70	1913	.....
200	Arizona	7.60	..	Crushers, stamp mill, tube mills, cyanidation	2.04	..	1917	.....
250	Arizona	22.00	96	Crushers, ball mills, tube mills, cyanidation	1.79	82	'17–'18	.....
270	Nevada	6.50	80	Crushers, rolls, ball mills, tube mills, cyanidation	1.59	70	1914	.....
400	Mexico	7.25	..	Crushers, stamp mill, tube mills, cyanidation	1.61	..	1912	.....
500	Nevada	5.00	..	Crushers, stamp mill, tube mills, cyanidation	1.12	..	1912	.....
1,000	Mexico	5.75	85	Crushers, stamp mill, tube mills, cyanidation	1.11	..	1912	.....
1,000	Nevada	13.70	92	Crushers, stamp mill, Chilean mills, tube mills, gravity concentration, cyanidation	1.97	75	1913	.....
900	Nevada	12.50	92	Crushers, stamp mill, Chilean mills, tube mills, gravity concentration, cyanidation	1.61	75	1914	.....

POWER REQUIREMENTS

	Horsepower Per Ton Milled Per Twenty-four Hrs.
Crushing only, product to contain 60 to 80 per cent minus 200 mesh	0.80 to 2.50
Coarse gravity concentration, 10 to 20 mesh	0.50 to 0.80
Stamp mills with vanners, 20 to 40 mesh	0.75 to 1.00
Gravity concentration, tables and vanners, 30 to 100 mesh	1.50 to 1.75
Concentration, all flotation	1.25 to 4.00
Cyanide mills, dry rolls, to 20 mesh	0.50 to 0.80
Cyanide mills, wet stamping to 80 mesh	2.00 to 3.50
Magnetic-separator mills	0.25 to 0.50
Combination stamp mills, 16 to 30 mesh	1.50 to 1.75

Size of product: all through 1½ to 3 in. Cost of breaking, per ton of mill feed, $0.07 to $0.13.

Secondary Crushing (intermediate crushing, fine crushing, stamping) follows breaking, and aims to give a product almost all of which passes a 4-mesh screen; it is performed with rolls, disk crushers, or stamps. Cost of secondary crushing, per ton of mill feed, $0.10 to $0.20.

Grinding (comminuting, pulverizing, primary grinding) gives a product of which 15 to 50 per cent passes a 200-mesh screen; ball mills, Chilean mills, or pans are the machines commonly used. Cost of grinding, per ton of mill feed, $0.10 to $0.20.

Sliming (regrinding, fine grinding, secondary grinding, tube milling) reduces a feed all of which passes a 10- to 20-mesh screen, and gives a product of which 90 per cent or more passes a 200-mesh screen. This is generally done in tube mills using pebbles or small balls; it is also done in ball and rod mills. Cost of sliming, per ton of mill feed, $0.15 to $0.50.

Cost of crushing to slime, for each percentage of product that will pass a 200-mesh screen, per ton of run-of-mine ore, ¾c. to 1½c.

Physiological Effects of Carbon Monoxide

Although the extremely poisonous nature of carbon monoxide is understood, there is little available information on the physiological effect of small percentages of carbon monoxide in otherwise respirable air. It is always a poison, whether in small or large proportion, and in the latter case is the most dangerous gas encountered in underground operations. Fortunately, it rarely occurs other than from a mine fire.

Doctors R. R. Sayers and F. V. Meriwether, of the Bureau of Mines, and W. P. Yant, chemist, recently concluded experiments to determine the physiological effects of low concentrations of carbon monoxide under varying conditions. The result of their investigation indicates that exposure for six hours to two parts of carbon monoxide in 10,000 caused a 16 to 20 per cent saturation of the hemoglobin of the blood, resulting in "very mild subjective symptoms of carbon monoxide poisoning" at the end of the test and no noticeable effects after the test. An exposure to four parts in 10,000 caused 15 to 19 per cent saturation at the end of one hour; 21 to 28 per cent at the end of two hours, and moderate to marked after-effects. Under the conditions of strenuous exercise, the time for saturation to 14 to 16 per cent was one hour in a mixture of two and one-half parts in 10,000 and resulted in moderate symptoms of carbon-monoxide poisoning with after-effects mild to moderate. At higher proportions of carbon monoxide up to four parts in 10,000, the poisoning and after-effects were slightly increased.

According to the investigators, high temperature and humidity, with a given concentration of carbon monoxide, cause more rapid absorption of the noxious gas than do normal conditions of temperature and humidity. It is of interest to note that none of the subjects experimented upon has shown any permanent deleterious effects from the exposure to carbon monoxide.

Technical Operations of the Chile Copper Co. During 1921

The annual report of the Chile Copper Co. contains a summary of mill operations for the year 1921. A total of 1,671,936 dry tons, assaying 1.70 per cent copper, was crushed. The primary crushing is by 84 x 60-in. jaw crushers. This is followed by No. 10 gyratory crushers, and by 48-in. vertical and horizontal Symons disk crushers, which prepare the ore for leaching. During 1921 the oversize on 0.371-in. square mesh of final product from the fine Symons crushers was 9.69 per cent, compared with 13.54 per cent during 1920. The average leaching extraction from 163 charges was 92.24 per cent.

In the tank house, only circuits A, B, C, D, and G were in service during the greater part of the year. Two new 24-in. wood-stave pipe lines were completed, making ample provision for supplying solutions to the tank house. The acid plant was closed down the entire year. Wire-bar furnace No. 1 was dismantled and completely rebuilt.

The following table shows the more important metallurgical data:

	Ore Crushed, Tons	Per Cent Copper in Ore Crushed	Average Tons Crushed per Operating Day	Per Cent Current Efficiency, Tank House	Tons Copper Produced	Per Cent Net Recovery
1918	3,745,083	1.64	10,762	82.4	51,068	82.2
1919	2,961,465	1.62	11,303	83.0	38,359	86.0
1920	4,243,301	1.51	11,760	82.83	55,566	89.68
1921	1,671,936	1.70	5,573	85.43	27,004	91.07

At the power house at Tocopilla, a total of 102,894,500 kw.-hr. was developed, requiring 125,107,927 lb. of fuel oil, or 1.215 lb. oil per kw.-hr. The 18,000-kw. extension to the station was practically completed at the close of the year.

USEFUL OPERATING IDEAS

A Sublevel Slicer

Type Devised by Cleveland-Cliffs Iron Co.'s Engineers Uses Trolley and Has Power Unit Distant from Breast

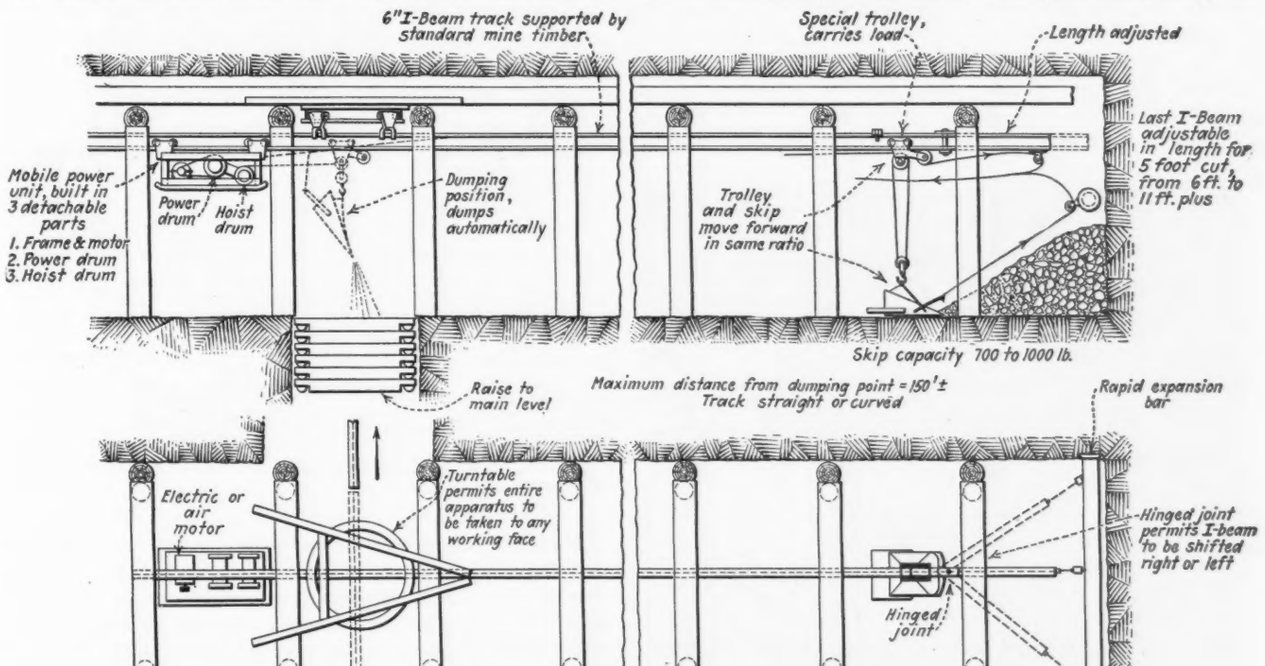
BY WILLIAM H. NEWETT

A NUMBER of underground loading machines have been perfected in the Lake Superior iron region during the last few years, and several different types are now being manufactured and sold. One of the newest inventions is a sublevel slicer, designed by H. O. Moulton and D. McCarthy, engineers in the employ of the Cleveland-Cliffs Iron Co. They have had one of these slicers at work in the company's Negaunee mine, at Negaunee, for four months, and the results are said to be satisfactory.

The special need for which the machine was designed was that of a small and flexible device which could be taken into any part of a mine and made to substitute for hand labor in the most inaccessible sublevel. In devising this the inventors have departed from the lines of other similar inventions which involved the use of a power loader placed as a unit at the breast, and have worked out a device the power unit of which is fixed at a point distant from the breast.

The machine in its simplest form consists of a scraper or shovel-skip which is forced mechanically into the dirt with a forward and upward motion, and, when filled, is hoisted to the carrying position and automatically locked on an overhead trolley, quickly transported to the raise or other dumping point, where an automatic device dumps it, when it returns to the working place. The entire operation is controlled through the use of cables by the operator seated at the power unit. When two machines are installed side by side in a drift, the shovel-skips will alternate, one going forward empty as the other comes back loaded. Only a small adjustment is needed at the breast to keep the shovel-skip moving forward into the dirt.

The machine which was tried out in the Negaunee mine has loaded, trammed, and dumped successfully at the rate of one ton in five minutes, using a skip holding one-fifth of a ton. More power would have increased this rate.

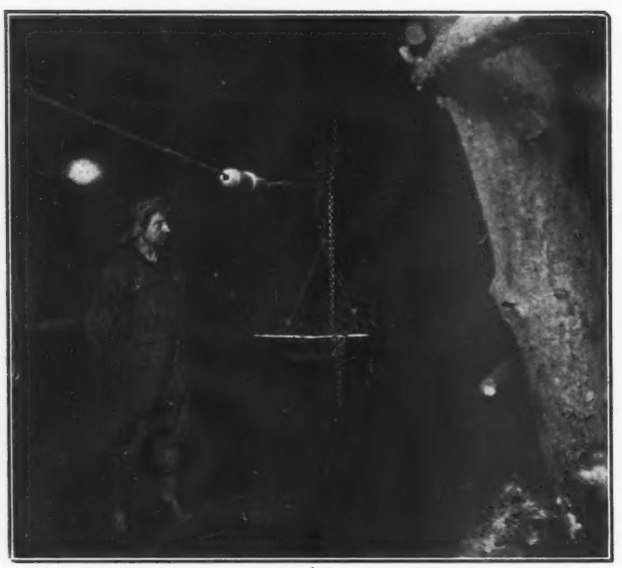

6"I-Beam track supported by standard mine timber
Special trolley, carries load
Length adjusted
Last I-Beam adjustable in length for 5 foot cut, from 6 ft. to 11 ft. plus
Mobile power unit, built in 3 detachable parts
1. Frame & motor
2. Power drum
3. Hoist drum
Power drum
Hoist drum
Dumping position, dumps automatically
Trolley and skip move forward in same ratio
Skip capacity 700 to 1000 lb.
Raise to main level
Maximum distance from dumping point = 150' ±
Track straight or curved
Rapid expansion bar
Electric or air motor
Turntable permits entire apparatus to be taken to any working face
Hinged joint permits I-beam to be shifted right or left
Hinged joint

Method of using Moulton and McCarthy sublevel slicer demonstrated

The device is designed to be operated by electricity, although where this is not available air may be used. The hoist is contained in a frame 2 x 2 x 4 ft. in dimensions, which is supported from an I-beam by means of trolley, so that it can be easily moved about. It is situated during the operation on the opposite side of the raise from the working face. The machine is equipped with two drums, which work independently, so that the operator has control of the scoop at all times. It is demountable into three parts, none of which weighs over 300 lb., the total weight being about 800 lb.

Sublevel slicer dumping into raise

The trolley is so designed that it trips the empty scoop near the loose pile of ore on the forward trip, and dumps the load automatically on the return trip. The scoop may be replaced with timber tongs or sling when timber is being brought from the main level through the raise and carried to the working face. Above the raise is a turntable, so that the slicer may be revolved



Sublevel slicer taking load

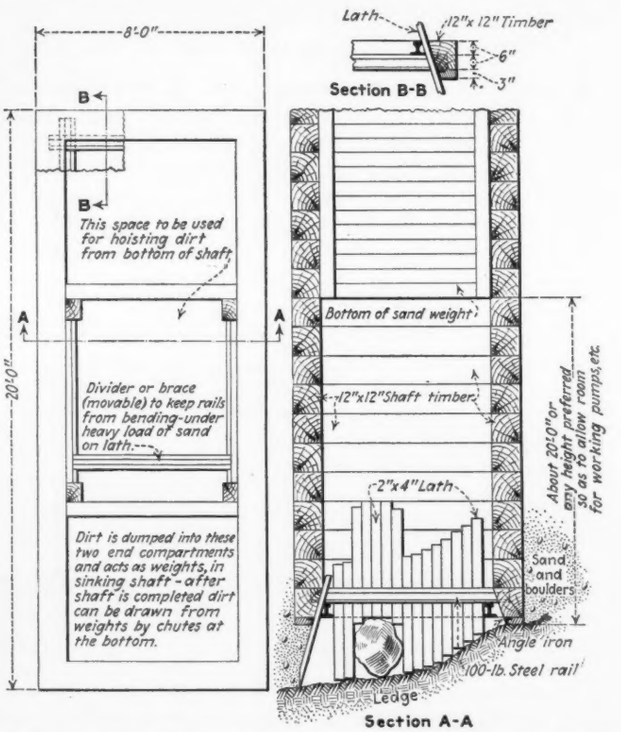
and used to work as many breasts as are available from one raise. Another advantage is that the machine can work equally well on a curved or straight track, being able to go around a curve on a 3-ft. radius, while idlers on the legs take care of the cables. The trolley and scoop can pass through a 3-ft. opening.

Dating Progress Maps

Frequent erasure of the date on current maps, progress drawings, and the like that are changed from time to time soon wears a hole in the original sheet. This may be avoided by cutting a small square from the lower right-hand corner of the sheet on which the drawing is made and filling this in, when blueprinting, with a square of the same material carrying the date.

Method of Sinking Drop Shaft in Soft Water-Bearing Soil

In a method of sinking drop shafts, cofferdams, and the like, which was worked out by C. T. Roberts, of Crystal Falls, Mich., use is made of 100-lb. steel rails, as shown in the accompanying drawing, the main object of which is to permit the lath to be driven at any time where there is likely to be an excessive inflow of sand and gravel, a frequent occurrence in a shaft of this kind. Such inflows often cause much damage, sometimes throwing the shaft out of line, especially if boulders are encountered.


8'-0"
B
B
This space to be used for hoisting dirt from bottom of shaft
A
A
20'0"
Divider or brace (movable) to keep rails from bending under heavy load of sand on lath.
Dirt is dumped into these two end compartments and acts as weights, in sinking shaft - after shaft is completed dirt can be drawn from weights by chutes at the bottom.
Lath
12"x 12" Timber
6"
3"
Section B-B
Bottom of sand weight
12"x12" Shaft timber
2"x4" Lath
About 20'0" or any height preferred so as to allow room for working pumps, etc.
Sand and boulders
Angle iron
100-lb. Steel rail
Ledge
Section A-A

Method of sinking drop shaft using 100-lb. steel rails

The illustration shows one edge of the shaft resting on the ledge, with about 3 ft. of difference in the contour of the ledge at the other side of the shaft. The lath is shown driven to the ledge and around a boulder. This will permit cutting down the ledge on high sides so that the shaft timbers will rest level on the ledge.

The steel rail dividers or braces can be used in any part of the shaft where the most weight comes while driving lath and can be moved at will along the flanges of the two side rails.

Shaft Arrangements

Spillage is unavoidable in skip-hoisting, and it is customary to arrange a bin below the skip compartments to receive it. The spillage bin is emptied into a car which is handled in a separate cage and compartment alongside of the skip compartment.

At the entrance to shaft compartments from stations some form of gate is necessary. In cage hoisting, a heavy wooden bar which is held by a pin at one end and caught in a metal crotch at the other is the customary arrangement. For skip hoisting a boiler-plate door is recommended, as there is always danger of ore falling down the shaft, and it may be projected into the station.

THE PETROLEUM INDUSTRY

El Dorado Oil Field in Arkansas Warrants Extensive Exploration*

In Spite of Unusual Features, Indications Are Encouraging — Possibility of Finding Similar Fields in Same Region

THE El Dorado oil field, in Arkansas, was discovered by the Constantine Refining Co. when that company's Armstrong No. 1 well struck an immense flow of gas, estimated at 40,000,000 cu.ft. per day, and a small quantity of oil. The oil men of the mid-Continent region paid comparatively little attention to this discovery for several months, although a few companies, acting on the advice of geologists, leased some land near the gas well; but when a well drilled by Mitchell & Busey came in on Jan. 10, 1921, with a flow of about 1,500 bbl. per day, there was a stampede for the field. Leasing and drilling were pushed with an intensity so tremendous that in spite of several months' delay in getting an adequate pipe-line outlet for the oil produced, the field was developed with remarkable rapidity. The oil sand is only about 2,150 ft. below the surface, and the rocks above it are mostly beds of shale and clay that are easily penetrated by the rotary drill. Wells that gave a large output were the rule rather than the exception, several yielding more than 10,000 bbl. per day, although most of these wells produced much salt water with the oil. The output reached about 82,000 bbl. per day during the week ending Aug. 20, 1921, but declined rapidly to about 32,000 bbl. during the week ending March 11, 1922. Since then the output has increased slightly.

STRUCTURE IN EL DORADO FIELD IS UNIQUE

Each oil-yielding district has its own peculiarities, and the rules that may guide prospecting in one area may not apply to another. The great number of test wells that have been drilled in southern Arkansas without finding oil in large quantity except in the El Dorado fields show either that the oil pools in this region do not bear the same relations to anticlinal structure that they commonly bear elsewhere in the mid-Continent oil fields, or that geologists have not learned how to locate the anticlines in this field by studying the surface formations.

The geologic structure of the El Dorado field is unlike that of any other known field of similar size. The studies made covered only the northern part of the producing area, but there is no reason to think that the structure of the southern part is materially different. If the sand, clay, and gumbo could be stripped off the producing bed in the area covered by the work, no large dome or great anticlinal arch would be uncovered. The surface of the oil sand is so nearly level that it might remind one of gently rolling prairies or of meadows made up in part of smoothly rounded knolls and swales or hollows whose slopes rise in even, sweeping curves. The evenness is interrupted by a number of low, almost vertical cliffs that mark faults where the rock has been broken and one side of the break has risen from 1 to 30 ft. above the other. There are probably a great many more of these breaks than have been identified. Almost without exception they trend northeastward, forming a sharp angle with the longer axis of the field, and most of the low folds that vary the flatness of the surface of the oil sands also trend northeastward.

SOME ANTICLINAL AREAS EXIST

A study of well records in areas east and west of the El Dorado field shows that this field is not upon a pronounced regional uplift, although there may be a slight bulge or gentle arch in the El Dorado region. The strata dip gently to the east and southeast over most of southern Arkansas. If the El Dorado field is on a regional bulge or uplift, there is a synclinal depression west or northwest of it. A flattening of the regional dip was detected, but no true syncline. Furthermore, if the field were on an uplift the strata immediately east of it would probably show steeper dips than are common in this region, but no suggestion of such steep dips was found. The location of this field is therefore not controlled by the manner in which the rocks are folded. There is no true major anticline here, and the minor folds did not control the distribution of the oil, although the gas in this pool does tend to concentrate in arched or domed areas. If the dates of completion and of average declines in initial production are taken into consideration, in order to compensate for interference from adjacent producers, the wells in these anticlinal areas are perhaps a little above the average for the entire field, but this initial production is not higher than that of wells in adjoining synclinal areas.

On the other hand, it cannot be said that in this field there is no relation between geologic structure and the accumulation of oil, for structure includes both folds and faults, and the faults were probably influential in forming the pool. Nearly every area of high productivity in the oil-yielding belt here considered is traversed by one or more faults. A strip of richly productive territory does not border each fault, but here and there along almost every fault there is a spot of unusual richness.

HOW THE POOL WAS FORMED

The Marlbrook marl is believed to be the source of the oil in this field, and the accumulation of enough oil in the Nacatoch above the Marlbrook to form a commercial field is probably due to a happy association of a source of oil, channels through which it could migrate, and a good reservoir bed. Oil was probably not formed everywhere in the Marlbrook, at least not in great volume, but in favored spots where it was laid down in shallow water and possibly raised above the sea from time to time, the conditions were right for the deposition and preservation of oil-forming matter. In any event, in

*Abstracted from Report of U. S. Geological Survey.

some places the Marlbrook appears to have supplied large amounts of oil to the overlying Nacatoch sand, and in others, where the structure is seemingly quite as favorable, it has supplied little or none. At El Dorado the zone of faults crossed a productive area in the marl. The oil moved up along the fault planes and accumulated in the upper part of the Nacatoch sand. Pronounced anticlinal folding and faulting and a rich spot in the Marlbrook together would have produced ideal conditions for the accumulation of oil, and under such conditions the water trouble that has been the curse of the El Dorado field would not have appeared. The beds of sandstone lie so flat, however, that the oil they contain does not saturate them to any great thickness; but, instead, it is found in thin layers at the tops of several beds in the upper part of the Nacatoch, and the remaining parts of these beds are filled with salt water. The gas, being more mobile than the oil, has migrated to the more prominent domes and has excluded most of the oil and the water from certain thin beds of sandstone under the arched areas.

If the formations just above the Nacatoch had contained porous sandstones, the oil, as it moved upward along the fault planes, would probably have formed small pools in them, for the faults are not limited to the beds below the top of the Nacatoch, but certainly cut the Arkadelphia clays, although these beds contain few sands. The faults may cut also the Midway beds, although this supposition cannot be definitely verified by the well records, but no evidence was found to indicate that they cut the Wilcox.

Source May Have Been Lower Cretaceous Beds

Instead of originating in the Marlbrook, the oil possibly may come from a much deeper formation, such as the Brownstown marl, the Eagle Ford shale, or the Lower Cretaceous beds. The depth of these formations below the Nacatoch is no obstacle to the migration of the oil, for the faulting that cuts the Marlbrook must also cut them, and if it could furnish channels for upward migration from the Marlbrook to the Nacatoch it could almost as easily furnish channels for migration from the deeper beds. If the oil came from the Brownstown marl, there may be chances of finding oil-reservoir beds in this formation or adjacent to it, and if it came from the Eagle Ford shale there is a good chance of obtaining it from the Blossom and Woodbine sands.

If the oil came from the Marlbrook marl, however, the chances of obtaining it from underlying formations are not exceptionally good, although these lower formations should not be utterly condemned. The records of other fields that draw oil from Upper Cretaceous formations prohibit such a blanket condemnation, for practically all fields that have yielded either oil or gas in notable amounts from the Nacatoch sand have yielded much greater amounts from either the Blossom or the Woodbine sands, or both. The lack of anticlinal structure at El Dorado, however, offsets this favorable feature. Where oil has been found in the Blossom or the Woodbine there is either pronounced regional uplift or strong anticlinal folding. In the Caddo and De Soto-Red River districts there are both. In the El Dorado district there is neither. The conditions that are associated with oil pools in northern Louisiana, and to which the formation of those pools is presumably due, are therefore lacking here, and production from the deep beds cannot be expected. Nevertheless, the deep sands should be tested.

A few wells in the El Dorado field have reported "showings" of oil or gas in beds in the Midway formation. The few reports that traces of oil have been found in these beds might be discredited, for enough oil to give a rainbow-colored film on the drilling water might accidentally get into a well, but showings of gas could not be thus explained, and it therefore seems evident that at least one bed in the Midway formation carries some oil and gas. This bed may lie about 1,150 ft. below the surface over most of the field, or about 970 ft. above the Nacatoch sand. Reported showings of oil or of gas in a number of wells that have been drilled within a radius of 40 miles of the El Dorado field suggest that an oil-bearing sand may lie at the base of the Midway formation, which in the El Dorado field is from 575 to 625 ft. above the Nacatoch. No careful tests of these shallow beds seem to have been made in the field, in spite of apparent advisability of such tests. Small water-free wells that would draw oil from a bed not more than 1,200 ft. below the surface would probably yield greater net profits than the more spectacular but less reliable wells that get oil from the underlying Nacatoch sand. Tests of shallow sands should be made carefully, for the gas in them is evidently under low pressure, and it would be easy for one to drill through a thin oil or gas-bearing sand without suspecting its presence.

Possible Extensions of the Field

A number of test wells should be drilled west of the gas-bearing area, for oil-bearing beds may possibly border the gas-bearing beds on the west and south as they do on the north and east. The extension of the field to the south of its present limits is to be expected, and determined prospecting to discover a northward extension is also justified by the peculiar type of structure. Operators should not accept a single dry hole as limiting the field in these directions. The producing territory at the present north margin of the field can probably be extended westward.

Parallel belts of faults separated by areas almost unfaulted may occur in southern Arkansas as they do elsewhere in the mid-Continent region, notably in northern Oklahoma and southern Kansas. If such a belt exists within a few miles of El Dorado, the other favorable conditions that combined to produce the El Dorado pool probably also exist there and a field much like the El Dorado field may be developed. Because of this probability the following suggestions are made:

1. If gas in volume is encountered in a wildcat well, the search for oil should be continued by wells drilled east, northeast, or southeast of the gasser.
2. If oil is encountered in a wildcat well, the extension of the oil-yielding area should be sought by other wells drilled either north or south of the discovery well.
3. Gas pressure should be conserved by shutting in gas wells. The maintenance of high gas pressure will help to promote a greater extraction of oil and to prevent water trouble.

The chances for finding new fields are not limited to zones of faulting, for there are probably anticlines in southern Arkansas fully as strongly developed as those on which the Homer and Bellevue fields of Louisiana are located. Even if some of the conclusions here presented may be questioned, other oil fields will no doubt sooner or later be discovered in southern Arkansas, for in view of the showings of oil obtained in widely scattered wells in this broad region it would be unreasonable to believe that there is only one place in it where the conditions are favorable to the formation of an oil pool.

Petroleum Statistics for March Show Large Increase in Stocks

According to the American Petroleum Institute's analysis of complete official petroleum statistics for March, 1922, there was an excess of domestic production and imports over indicated total consumption, including exports, amounting to 15,710,058 bbl. for the month, or at an annual rate of 184,973,240 bbl. This compares with an excess production for the previous month of 12,326,491 bbl., or at an annual rate of 160,684,680 bbl., and an excess production for March, 1921, of 8,369,921 bbl., or at an annual rate of 98,548,905 bbl. The analysis which takes into consideration changes in pipe-line and tank-farm crude stocks, in crude and liquid refined stocks held at refineries, and in stocks of Mexican oil held in the United States, follows:

STATISTICS OF PRODUCTION AND CONSUMPTION OF PETROLEUM

Figures in Barrels of 42 Gallons

	February, 1922	March, 1922	March, 1921
Domestic crude-oil production	40,814,000	46,916,000	40,905,000
Imports, all oil	12,428,075	14,315,176	12,701,019
Total production and imports	53,242,075	61,231,176	53,606,019
Annual rate of domestic production and imports	694,048,595	720,947,635	631,167,490
Increase of pipe-line and tank-farm crude stocks	10,487,000	10,045,000	7,041,000
Increase of crude and liquid refined stocks at refineries	296,309(a)	4,428,058	1,072,921
Increase of Mexican stocks in United States	2,136,000	1,237,000	256,000
Net increase of all stocks	12,326,491	15,710,058	8,369,921
Indicated consumption	40,915,584	45,521,118	45,236,098
Annual rate of consumption	533,363,915	535,974,395	532,618,585
Excess of production	12,326,491	15,710,058	8,369,921
Annual rate of excess of production	160,684,680	184,973,240	98,548,905

(a) Decrease.

The annual rate of excess production over consumption of petroleum east of the Rockies was 169,575,350 bbl. in March, compared with 137,276,500 bbl. for the previous month, and 74,729,005 bbl. for March, 1921. Exports of all petroleum to foreign countries and to non-contiguous territories of the United States totaled 6,568,966 bbl. in March, 4,920,831 bbl. in February, and 5,666,440 bbl. in March, 1921. The indicated domestic consumption of petroleum and liquid products was 36,332,129 bbl. in March, as compared with 33,572,004 bbl. in February, and 37,106,837 bbl. in March, 1921. The excess of domestic production over indicated domestic consumption was 10,583,871 bbl. in March, compared with 7,241,996 bbl. in February, and 3,798,163 bbl. in March, 1921.

Production Increased in March

Domestic production of crude oil totaled 46,916,000 bbl., a daily average of 1,513,419 bbl. in March, compared with 40,905,000 bbl., a daily average of 1,319,516 bbl., in March, 1921. There were 1,322 producing oil wells completed in March, against 1,143 in February and 1,450 in March, 1921. Producing oil wells completed east of the Rockies in March totaled 1,264, against 1,098 in February and 1,384 in March, 1921.

Imports of all oil into the United States in March totaled 14,315,176 bbl., a daily average of 461,780 bbl.; in February, 12,428,075 bbl., a daily average of 443,860 bbl.; and in March, 1921, 12,701,019 bbl., a daily average of 409,710 bbl. Pipe-line and tank-farm crude stocks as of March 31 totaled 201,516,000 bbl., an increase of 10,045,000 bbl. over stocks at the end of February. February stocks increased 10,487,000 bbl. over those of the preceding month.

Little Was Accomplished at the Recent Oil Conference in Mexico

Special Correspondence from Mexico City

Petroleum conditions in Mexico are very much "up in the air." Though the exports for April reached 17,000,000 bbl., or an increase of 700,000 bbl. over March, the fact remains that in the last four months not a well of importance has been brought in, and the production depends almost entirely on the Toteca and Cerro Azul fields, and everybody knows that these fields are, under present methods and rate of production, approaching exhaustion.

Notwithstanding optimistic reports given out after the recent conference here, between heads of the important companies in the United States and the Secretary of the Treasury—they were notably vague and lacking in details—the impression prevails that nothing of great importance was accomplished. The oil men agreed to pay the export tax every ten days instead of monthly, and the government, it is believed, agreed to be "easy" on the oil men. As to the efforts of the oil men to nail the government down to something tangible that might indicate what operators may expect in the future, nothing was accomplished.

A sword of Damocles, in the form of a special commission to examine into all titles of oil lands, is still hanging over the producers, with a presumed gentlemen's agreement that the commission will not get immediately or offensively busy, in the performance of its official functions.

In the meantime there is considerable activity in securing wildcat lands in the extreme southern part of the country. Most of the purchases or options are taken by large oil concerns already operating here. In Tabasco, Chiapas, and on the west coast of Guerrero actual drilling is going on in an attempt to prove some of the territory.

Standard Oil Co. of California Active in Montana Oil Fields

Strike of a big flow of gas in the No. 2 well of the Standard Oil Co. of California, drilling jointly with the Transcontinental Oil Co. near Armells, Fergus County Mont., has again turned active interest toward that section of the state. According to reports the flow of gas was estimated at 10,000,000 cu.ft. The gas was encountered in the Kootenai sands 300 ft. above the Ellis sands. The Ellis formation carries oil at Kevin. The Standard of California and the Transcontinental control leases in excess of 30,000 acres in this wildcat and largely unexplored structure.

In No. 1 well the company encountered gas at 1,250 ft., although the flow was not as large as that in No. 2 well. Almost coincidental with the report of the discovery at Armells was the announcement that the California company had opened offices in Great Falls from which its operations in the Montana fields would be directed.

From Great Falls also comes the report that the Standard has acquired five tracts in the Kevin-Sunburst district, largely in the southern end of the new field. On the Gas Ridge anticline the California company has about 2,000 acres blocked up. It is reported to be paying cash for all leases that it is acquiring in the prospective campaign of exploration.

Geologists of Note

HORACE V. WINCHELL

HORACE V. WINCHELL is naturally a geologist, both his father, Newton H. Winchell, and his uncle, Alexander Winchell, being distinguished and devoted geologists. Under these family instructors Horace studied earth science, graduating from the University of Michigan, where Alexander Winchell was professor of geology, in 1889. As his father was State Geologist of Minnesota, it naturally came about that Horace made his first field studies as assistant geologist on the Minnesota Geological and Natural History Survey in 1889-91. This is a distinction Mr. Winchell shares in common with the editor of this journal, who got his first field experience on the same survey in 1893, being initiated into this work by Professor N. H. Winchell and Horace Winchell. The result of Horace Winchell's first field work was the publication, in collaboration with his father, of the report on "Iron Ores of Minnesota," published in 1890, and in 1892 he published the first reconnaissance report on the Mesabi Range. The term "taconite," used widely in Minnesota to apply to the iron-bearing rocks, was proposed by the Winchells. A natural inclination toward business soon led Mr. Winchell into the field of commercially applied geology, and in 1892-93 he was in charge of explorations for iron on the Mesabi for the Minnesota Iron Co. From 1893 to 1898 he was in general consulting practice, with headquarters at Minneapolis. He then went to Butte as geologist for the Anaconda Copper Mining Co. and remained there eight years, till 1906. There he devised and initiated the system of careful and methodical mapping and painstaking recording of data for which the geological staff of the Anaconda is noteworthy to this day. He also was attracted by the problem of the origin of the rich copper sulphides, such as chalcocite, and, together with Dr. C. F. Tolman, now professor of geology at Stanford University, he succeeded in producing chalcocite by laboratory experiments, under such conditions as to indicate the secondary origin of this sulphide. It was largely that work that opened the eyes of other visiting geologists to the importance of secondary copper sulphides as a result of the alteration of lean primary sulphides by surface waters, and at nearly the same time Emmons, Weed, and Van Hise published the outlines of the now famous explanation. In 1906 Mr. Winchell left Butte and became geologist for the Great Northern Ry. Co., in which capacity he continued for two years. Since 1906 he has been in general consulting practice as an economic geologist. During that period he has specialized particularly in the geological and legal interpretation of the obscure problem of the law of the apex, and scarcely a great legal contest on this score between two mining companies has occurred for years without Mr. Winchell's services being requisitioned, usually as the chief expert on one side or the other. While he has thus become a redoubtable specialist both in the geology and the law of these cases, he is one of the staunchest opponents of the law, and has done more than any other man toward its repeal and its substitution by some more reasonable measure. He is one of the members of the committee which drafted the proposed new mining law, now under consideration by the Mines and Mining Committee of the House of Representatives. He gives freely of his time to technical and scientific societies, and in recognition of his qualities was elected president of the American Institute of Mining and Metallurgical Engineers in 1919, where he served most acceptably. He has the ability to deliver a forceful and throughtful address.

HORACE V. WINCHELL

When *Economic Geology* was founded by a group of American economic geologists, at the suggestion of J. E. Spurr, Mr. Winchell became one of the founding group. The *American Geologist* had long been edited by his father, Professor N. H. Winchell, and one of Horace Winchell's contributions to the new journal of *Economic Geology* was to turn over to it the *American Geologist*, with its traditions, good will, and subscribers, thus giving it at the outset an unusual start.

A firm believer in what he believes in; a good friend; an outspoken opponent; a public-spirited citizen, is Horace V. Winchell.

SOCIETIES, ADDRESSES, AND REPORTS

The Technical Side of Our Natural Resources*

The volume and extensiveness of the natural resources of the United States are probably not equaled in any country in the world. The component parts of everything used in our industrial life comes from the ground or grows upon its surface.

If we would analyze the bringing together of natural resources used in the structure we are now in, we should probably find that the timber came from Florida, the stone from Bedford, Indiana, the iron from the iron mines along Lake Superior, and the glass from silica deposits of Illinois.

All of the wealth represented by all of the building of cities, villages, railroads, steamships and industries comes under one deduction, which has given engineers, economists, accountants, geologists, and law makers so much trouble. That deduction on an income-tax return is depletion.

Innumerable positions have been taken by both the Government and the various industries since the imposition of the excise tax law of 1909. I cannot tell you why no depletion was allowed mining and oil operations under that act, though timber companies were allowed it, except that the Supreme Court in the famous Sargeant Land Co. case said the law did not provide for it. Under the 1913 income-tax law, the same industries were again treated differently, the mining companies being limited on their deduction for wasting assets to 5 per cent of the gross value at the mouth of the mine or well, though no such limitation was provided for regarding timber operations. We are not concerned with these limitations except that it is sometimes hard to explain to the taxpayer why we will not let him have depletion when it will help him and then make him take it for invested capital purposes in a year when it again hurts. The law under which we are now operating says a reasonable amount shall be deducted for depletion.

As practically all mining property was acquired prior to March 1, 1913, we are confronted mainly with the problem of establishing the value of the mine on that date and perhaps in a considerable number of cases with the clause relating to discovery since that date.

The revenue law provides three ways of determining the value of a mining property: (1) The cost of purchased property on March 1, 1913, or later; (2) the fair market value if purchased earlier than March 1, 1913; (3) revaluation in either of the other cases provided since March 1, 1913, or since purchased, subsequent to that date new discovery in unproven ground results in a value disproportionate to the value prior to discovery.

Practically all mines require a value as at acquisition, for the reason that seldom are any mines purchased with cash, nearly all being acquired by an issue of stock. There probably could not be money enough got together by a group of men to purchase the Utah Copper Co. or the Chile Copper Co.

By using strictly engineering methods it is possible for two sets of valuations to arrive at approximately the same results; i.e. by starting with the same facts there need be no great disparity in the result, because practically all great natural-resource companies carry an engineering department.

To give you an idea of the success of this branch of the Natural Resources Division, I do not believe that a single case has gone to court on strictly a difference of opinion regarding the value of property turned in for stock or a value as of March 1, 1913, for depletion purposes. It is possible much more accurately to gage values by transfers of near-by or similar properties in certain cases of oil and coal lands, as these in recent years have been subject to rather frequent changes of ownership, but these methods, except in occasional instances, do not yield a safe basis for valuation of metal mining properties. Stock-market quotations may, under some circumstances, afford a rough check for valuations arrived at by more direct methods, but in themselves can ordinarily be given little weight, for a variety of reasons. For instance, the asset value of United States Steel is about $235 per share, but it can be bought in any quantity today around $100 per share. The anticipation of things which are likely to happen or not to happen causes wide fluctuations in a stock market, but has nothing to do with real value. The attitude of the department in the past has been largely, what would a willing seller take for a property?

Inasmuch as the inception of valuation in the complex metals relies on factors such as tonnages and yield of ores which are necessarily estimates and approximations at best, it might seem natural to conclude that all subsequent steps could with just as much permission be of only about the same accuracy. Such an impression, if one exists, is erroneous, for after the basis is established the answer is purely one of mathematics.

I wish to call your attention to a phase of our taxation problem peculiar to all cases audited in the Natural Resources Division, which has long been recognized by economists and mining engineers but not in our revenue laws until recently: i.e., the principle of wasting assets. The apparent income for a given year's operations is part profit and part return of capital. The operator who sells his metal or his coal is selling not only his product but at the same time a part of his mine. The gross receipts must cover both. From my observation, the failure to provide for this feature has led to almost disastrous results.

The amount allowed as a deduction for Federal tax purposes has varied in almost every law. Under the present statutes, this provision for wasting assets we will find on the liability side of our balance sheet, under the name of reserve for depletion, which may be set up on various basic dates, including a reserve on cost, March 1, 1913, value, and probably a discovery value. In a case of this kind this reserve account must be analyzed to distinguish what part is a real reserve and what part takes on the status of surplus and becomes capital.

The large exploration companies are offered hundreds of prospects for every one taken up. The report of a large mining company tells of 3,000 investigations, and only one property examined and proved worth buying. Each prospector thinks he has discovered a mine of untold wealth, but its wealth usually remains untold and this suggests a prevalent error to regard a mine as a mint and the ore as coin, whereas the truth is mining is a branch of manufacture and the ore is only the raw material, and as such is subject to the uncertainties prevalent where it is situated, such as fuel and water, not only for sustaining life but for lights and power; the cost of living; the price of labor; the means of reduction, transportation; protection of law, and civilization generally.

Up to the present time, under all laws up to the act of February, 1919, depletion has not been allowed in arriving at taxable income on the March 1, 1913, value of a lease, but an amortization of any cost at time of purchase as development capitalized is allowed. This point is now being strongly urged in several cases, and one Federal court, in the Allworth Stevens case, ruled the deductibility of a March 1, 1913, value in the case of a sublessor.

By a special provision of the act of February, 1919, the depletion must be equitably prorated between the lessee and lessor on the March 1, 1913, value.

*Abstract of a paper presented by H. L. Simcoe, assistant head of the Natural Resources Division, at a recent meeting of the Income Tax Unit.

Whether there is any realized appreciation to be added to surplus for invested capital purposes depends entirely on how it has been treated on the taxpayer's books. If depletion is based on cost and deducted on cost, there is *never* any realized depletion to add to surplus, for the surplus account is correctly stated. It is automatically there.

If depletion is deducted in the taxpayer's books on a March 1 value or a discovery value in excess of cost, and thereby understates his net income to arrive at a taxable income which is reflected in a reduced surplus account, the difference between cost and deductible value is realized by sale, and the difference should be added to surplus, providing it has not been paid out in dividends and is still in the business.

It has been held an operating deficit cannot break down a surplus created by a realized appreciation, thereby giving it the status of a paid-in surplus instead of an earned surplus. However, I think this is a debatable subject, as it would appear that this is a surplus built up by non-taxable income realized by sale in the regular course of business.

There are some cases in which there is a depletion allowance even though no ore has been removed. This happens in the case of an advanced royalty, where the owner has leased a mineral property for a term of years, with a requirement in the lease that the lessee shall extract and pay for annually a specified number of tons, or other units of measurements agreed to, of such mineral, or shall pay annually a specified sum of money which shall be applied in payment of the purchase price, or a royalty per unit of such mineral whenever the same shall be extracted and removed from the leased premises; the value in the ground to the lessor, for purposes of depletion, of the number of units so paid for in advance of extraction, will constitute an allowable deduction from income of the year in which such payments are made. No deduction for depletion by the lessor shall be allowed in any subsequent year on account of the extraction or removal in such year of any material so paid for in advance and for which deduction has once been made.

If for any reason a mineral lease is terminated where advance payments have been made and depletion has been allowed the lessor, the amount allowed becomes income in the year the lease is surrendered. Since this is a provision of the later regulations and is not mentioned in the previous issues, we have had several contested cases falling under this provision.

In conclusion, let me say, taking it for granted I have shown you there is no formula which can be used indiscriminately, that there is no place you can turn to get the correct answer, but that in the last analysis many valuations are questions of judgment which must be left to men who are familiar with the industry and the field. Such men are attached to the Natural Resource Division grouped into industries, so let us leave the shoemaker to his last, the miner to the mine, and the bookkeeper to his books, and thus give us a division of labor, and each will speak the language in which he is trained.

Hopeful Elements in the European Situation

"The European industrial situation is by far the most outstanding single factor in our foreign trade," according to Dr. Julius Klein, director of the U. S. Bureau of Foreign and Domestic Commerce of the Department of Commerce. Speaking on May 22 before the First National Convention of American Importers and Exporters at the Pennsylvania Hotel, New York City, he declared that "it is by all odds the most conspicuous beacon on our commercial horizon by which our overseas efforts are to be guided. On the one hand it shows the way to those markets across the Atlantic which buy every year nearly 60 per cent of all our exports. On the other, it indicates the possible menace of European competition with American goods in other markets such as the Far East and Latin America. "The Continent as a whole," said Dr. Klein, "and especially the United Kingdom, which is by far our best customer, is getting back to normal production of foodstuffs and, unless a new drought or crop failure occurs, this season will import reduced quantities of edible necessities.

"The various European countries are gradually returning to a saner political outlook and to a more complete recognition of their own economic situation. France is gradually realizing that her budget must be balanced out of current revenues, and that she cannot rely on German reparations. Italy has been able to effect cuts in government expenditures and is weathering the crisis caused by the Ansaldo and Banca di Sconto troubles.

"In Belgium the boom of 1921 proved to have been rather artificial, and due to temporary causes, chiefly the decline of German competition. The encouraging movement was checked after Christmas by the rise in French exchange and British competition in coal, iron and steel. Coal production has held up fairly well, however, and iron and steel production has increased since January.

"German industrial production and general business are stagnant. Labor costs are rising, larger proportions of raw materials must be imported and the production of fuel is decreasing slightly. The productivity of German labor is less by 20 per cent or 25 per cent than before the war, on account of the lowering of the standard of living. All these and other factors have, apparently, brought present German production in general down to about 60 per cent of the pre-war standard.

"In general, it may be noted that the process of normalizing the industrial situation is proceeding slowly but steadily.

Research Fellowships in the School of Mines, University of Alabama

The School of Mines of the College of Engineering of the University of Alabama offers five fellowships in mining and metallurgical research in cooperation with the U. S. Bureau of Mines. The fellowships are open to graduates of universities and engineering schools who have proper qualifications to undertake research investigation. The value of each fellowship is $540 per year of nine months, beginning Sept. 1. Fellowship holders will be required to register as graduate students and to become candidates for the degree of Master of Science unless an equivalent degree has previously been received. The fellowships have been established for the purpose of undertaking the solution of mining and metallurgical problems of special importance to the State of Alabama and the Southern States.

The following problems have been selected for the year 1922-1923:

1. Beneficiation of iron ores.
2. The preparation, treatment and uses of non-metallic minerals, such as clay and barite, in the industries other than the ceramic and chemical industries.
3. Metallurgical coke.

Fellows will be exempt from all laboratory and non-resident fees and will be required to pay only the following: (a) Matriculation fee of $10; (b) student activities fee of $13.50 per year, which includes subscription to student publications and admission to all athletic contests; and (c) a diploma fee of $15.

Applicants should send a copy of their collegiate records from the registrar's office of the institution where they have graduated. They should also state their professional experience and give the names and addresses of at least three persons who are familiar with the training and ability of the applicant. Applications are due not later than July 15 and should be addressed to H. D. Pallister, Professor of Mining Engineering, School of Mines, University of Alabama, University, Ala.

Salt Lake City To Protest Cut in Government Appropriation

The possible curtailment for the coming fiscal year of the Federal appropriation to the Salt Lake Station of the U. S. Bureau of Mines (which is under the joint direction of the Bureau and the University of Utah School of Mines) as announced by Dorsey A. Lyon, director of the Bureau, will be protested by the Mining Committee of the Salt Lake City Commercial Club. Co-operation is promised by other local mining men and the Utah Chapter of the American Mining Congress. The work of the local station was carried on by funds furnished jointly by the Government and the State of Utah. The Salt Lake City Station was the first to be established in the Far West.

MEN YOU SHOULD KNOW ABOUT

Harry L. Day has moved from Berkeley, Cal., to Portland, Ore.

H. Foster Bain sailed from Seattle for Juneau, Alaska, on May 17.

C. W. Knight, associate provincial geologist of Ontario, will investigate the South Lorrain silver area.

Gordon Murray, of Murray brothers, the discoverers of the gold-bearing area of Elbow Lake, Manitoba, is in Montreal.

W. H. Blackburn, general manager of the Tonopah Mining Co., has returned from a business trip of several months to Nicaragua.

Arthur W. Jenks has gone to the northern part of the Province of Quebec to examine mining property for New York interests.

C. Colcock Jones is registered at the American Club, Mexico City, and expects to be at that address until the middle of June.

Prof. Russell D. George, state geologist of Colorado, has received the degree of LL.D. from McMaster University, Toronto.

John G. Kirchen, general manager of the Tonopah Extension Mining Co., left Tonopah on May 12 on a business trip to Eastern points.

Walter Douglas, president of the Phelps Dodge Corporation, is making a general inspection of the corporation's southwestern holdings.

D. C. Jackling last week visited Ray and Hayden, Ariz., in connection with details of arrangements for resumption of work on the Ray mine and mill.

M. R. Campbell is studying the geology and physiography of that part of the Shenandoah Valley in which the newly discovered caverns are situated.

A. G. Burrows, of the Ontario Department of Mines, will make an examination of the Porcupine gold area, including the underground workings of the mines.

Charles Camsell, Canadian Deputy Minister of Mines, and **Prof. S. F. Kirkpatrick** have been accorded the honorary degree of LL.D. by Queens University, Kingston, Ont.

W. C. Alden is in Montana to continue his studies of the Tertiary and Pleistocene bench gravels and glacial phenomena in the plains of eastern Montana and western North Dakota.

C. M. Weld, of Weld & Liddell, will return to New York about June 1 after a month's absence in West Virginia, Tennessee, and Alabama on examination work, principally on coal properties.

R. H. Sargent is in charge of a party which is en route to Alaska to make topographic and geologic surveys in the Cold Bay oil region. Mr. Sargent will be assisted in the topographic work by **R. K. Lynt.** The geologic work will be done by **A. A. Baker** and **W. R. Smith.**

J. E. White, is engaged in making an examination of the Uvada mine and milling equipment. This mine is an old silver property in the Cold Spring district, fifteen miles north of Modena, on the Salt Lake R. R.

David B. Rushmore, chief engineer of the Power and Mining Department of the General Electric Co., has recently been appointed to the staff of consulting engineers of the company. He will be succeeded by **K. A. Pauly,** formerly head of the steel mill section of the power and mining department.

H. W. Hardinge has left for a tour throughout the West. The purpose of this trip is to make a general survey of conditions in both the mining and industrial fields.

Major A. W. Davis has been appointed resident mining engineer of Mineral Survey District No. 3, British Columbia. His headquarters will be the town of Kamloops. He assumed the duties of his new office on May 15. Major Davis succeeds the late **R. W. Thomson,** who died some months ago.

F. W. McNair, president of the Michigan College of Mines, at Houghton, has been appointed a member of a joint committee representing the Society for the Promotion of Engineering Education and the National Industrial Conference Board.

C. E. Siebenthal, of the U. S. Bureau of Mines, has arrived in the Tri-State field for a stay of probably three months, during which time he will complete his study of the geology of the Oklahoma and Kansas sections of the field, a work started by him before the war. He will make his headquarters at the Miami Hotel, at Miami, Okla.

C. W. Merrill gave a luncheon for **B. C. Yates,** general manager, and **W. J. Sharwood,** metallurgist, of the Homestake Mining Co., at the Pacific Union Club, San Francisco, on May 16. Those present were **C. W. Merrill, F. W. Bradley, A. C. Lawson, Edmund Juessen, Charles Janin, E. A. Julian, E. Higgins, F. L. Sizer, E. H. Benjamin, Frank G. Baum, Frank H. Probert,** and **C. T. Hutchinson.**

Louis S. Cates, for a number of years assistant general manager of the Utah Copper Co., and consulting director of the Ray Consolidated Mining Co., has been made general manager, director, and assistant secretary of the Utah Copper Co., to succeed **Robert C. Gemmell,** who becomes assistant managing director of the Jackling group of porphyries, including the Ray, Chino, Utah Copper and Nevada Consolidated properties. Mr. Cates had charge of the construction work at the Boston Consolidated as his first experience in the camp of Bingham. This property later became a part of the Utah Copper holdings. As general manager of the Ray Consolidated, Mr. Cates developed a system which made it economically possible to mine low-grade porphyry by underground methods.

Mining engineers who recently visited San Francisco, Cal., included: **F. Searles,** of Grass Valley, Cal., **D. S. McAfee,** of New York City; **R. A. F. Penrose,** of Philadelphia, Pa.; and **Horace V. Winchell,** of Los Angeles.

Mining and metallurgical engineers visiting New York City last week included: **R. K. Neill,** of Spokane, Wash.; **E. S. Moore,** of State College, Pa.; **T. Antisell,** of Washington, D. C.; **William McCullough,** of Cleveland, Ohio, and **R. V. Whitman,** of Ebensburg, Pa.

OBITUARY

Pierre Tetreault, of Tetreaultville, Que., died suddenly on May 14 at the age of sixty-four years. He was a pioneer zinc miner of Butte, Mont., where he discovered the Arius mine. Returning to Quebec, he founded the village that bears his name. Mr. Tetreault was the owner of several mines in Quebec province.

Alva P. Thomas died in Aztec, N. M., April 10, at the age of forty. Mr. Thomas had been engaged in mining in the west for twenty years, having held important positions with the Anaconda Copper Mining Co., the Goldfield Consolidated, and the Goodrich-Lockhart Co. In 1915, Mr. Thomas went to Peru to take charge of some mining properties for the Backus and Johnston Co. Upon his return, he re-entered the employ of the Anaconda Copper Mining Co. At the time of his death Mr. Thomas was in partnership with his brother-in-law in the cattle-raising business near Blanco, N. M.

Henry Marion Howe, one of the leading metallurgists in the United States, and for many years professor of metallurgy at Columbia, died on May 13 at his home in Bedford Hills, N. J. Born in Boston seventy-four years ago, he was graduated from Harvard in 1869 and in 1871 from the Massachusetts Institute of Technology, later receiving the degree of LL.D. from Harvard and Lafayette. He was a son of the late Julia Ward Howe. He received his degree of bachelor of arts from Harvard in 1869, and his degree from the institute after two years' study. After his graduation from the institute he went into practical work in the steel industry at Troy, N. Y. From there he was called to Joliet, Ill., to become manager of the great Bessemer steel works. Everywhere his genius and attainments in his chosen career brought him honors. Among them were a knight of the order of St. Stanislaus by Emperor Nicholas of Russia, the Elliott-Cresson medal of the Franklin Institute, and the gold medal of Verien Beforderung des Gewerbfleiss of Germany. He was made a chevalier of the Legion of Honor in 1901, and was president of the jury of awards on mining and metallurgy at the Columbian Exposition and at the Paris Exposition.

THE MINING NEWS

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Leading Events

THE REPORT of the Evans Committee on its investigation of the American Smelting & Refining Co. has been issued to the stockholders. The management is taking steps to insure the continuance of its control at the annual meeting next month.

Debate on the tariff bill is becoming marked with bitterness. Little progress is being made.

Public test of the Hawksworth removable drill bit was made by the Anaconda company at the St. Lawrence mine recently, with excellent results.

The Tennessee Copper & Chemical Corporation has begun the erection of a flotation plant.

United Verde is experimenting with heap leaching under the direction of Joseph Irving.

Federal Tax Claim Against Consolidated Arizona Compromised

Consent to the disposal of the property of the Consolidated Arizona Smelting Co. to John I. McNeil for $1,000,000 was given in the United States Court on May 17. It was stated that a compromise had been effected of the Government's claim for about $600,000 for excess-profits taxes. It is understood that this clears the way for the operation of the Humboldt smelter early in June.

Tennessee Copper Building Flotation Plant

Licenses from Minerals Separation have been taken out by the Miami Copper Co. and the Tennessee Copper & Chemical Corporation. Construction of a flotation plant has been started by the Tennessee company, to treat its fines, hitherto largely stocked. The capacity of the initial installation will be sufficient to increase by 50 per cent the copper output of the company, which is normally about 10,000,000 or 12,000,000 lb. annually. The ultimate capacity planned has not been divulged.

Tennessee Copper's ore has always been smelted directly, sulphuric acid being manufactured from the furnace gases. The output of copper has consequently been directly affected by the demand for acid. Erection of the flotation plant is expected to remedy this situation to some extent. The additional copper so produced will thus be made at a lower cost.

Granby May Build Mill

The Granby Consolidated Mining, Smelting & Power Co. is thinking of building a concentrator of about 1,000 tons' capacity to handle low-grade siliceous ores from the Hidden Creek mine, in British Columbia. No decision has been reached as yet by the management.

Evans Committee Reports on Investigation of American Smelting & Refining Co.

Majority Criticises Management on Certain Points—Elihu Root Holds Findings Unjust—Minority Upholds Guggenheims —Call for Proxies Out

WHILE conceding that the business management of the American Smelting & Refining Co. has been successful and that a highly efficient organization for the conduct of its business has been built up, the majority report of the Evans committee of stockholders nevertheless sets forth certain transactions wherein officers and directors of the company are, in the committee's opinion, subject to criticism in their dealings with other corporations in which also they were interested. It also condemns "the policy of paying large dividends during the years of very profitable business without making sufficient additions to capital reserves."

The report is signed by Henry Evans, Clarence H. Kelsey, Henry K. Pomroy, and Willis D. Wood, four of the committee's seven members. The three members dissenting are E. C. Jameson, Lyman Candee, and Wilfred Shore, who were elected directors at the last annual meeting on April 6, 1921. A minority report defending the management of the company is signed by them. They had been added to the membership of the committee at the company's request and as its representatives.

The Evans committee was organized on March 24, 1921, to investigate the management and affairs of the company, as a result of the charges of mismanagement made by Karl Eilers during his campaign to oust the Guggenheims from control. As then agreed, the committee was to conduct the investigation through its own agents and report its own conclusions, but the report, before distribution to stockholders, was to be submitted to the company to be examined by William H. Taft, on behalf of the company, if the latter wished. Later it was understood that Elihu Root would act in place of Mr. Taft. George W. Wickersham acted as counsel to the committee and concurred in the finding of the majority.

At the time of the merger of M. Guggenheim's Sons with the American Smelting & Refining Co., states the majority report, the latter company acquired from the Guggenheims properties worth $14,713.000, giving in exchange stock having a market value of $34,804,000 and which was later disposed of for $37,411,720. Regarding this transaction, the report says:

"The statement made by S. R. Guggenheim to the stockholders in 1921, that at the time of the merger the business of M. Guggenheim's Sons was earning over $4,000,000 a year, appears, from all the facts ascertained in connection with this investigation, to be very greatly exaggerated."

Ten pages of the report are devoted to a discussion of the company's relations with the Federal Mining & Smelting Co. The fall of the Federal company from its position in 1907, when its common stock paid 18 per cent and sold at $196, to that at the present, when its deficit is placed at $10,000,000 by the committee, is shown. The report says:

"In 1908 the failure of the Federal company may be said to have begun. From the beginning of the fiscal year 1905 to the beginning of the fiscal year 1908, the dividends paid on preferred stock amounted to $2,342,033.71, and the dividends paid on common stock

amounted to $2,372,009.10, together amounting to $4,714,042.81. During the same three-year period the total deduction from earnings for overhead, construction, exploration, development, depreciation, and ore depletion (i. e., for all purposes except operating expenses) amounted to less than $650,000, of which less than one-half was deducted for ore depletion.

"There was only half as much common stock as preferred stock, yet during the three-year period preceding the decline of the company the amount paid in dividends on common stock exceeded the amount paid in dividends on preferred stock.

"The earnings used for dividends amounted to more than 26 per cent of the company's total capital, while the earnings used for ore depletion amounted to less than 2 per cent of such capital."

In connection with the transactions with other companies which the committee considers subject to criticism, particular reference is made to the organization and issuance of various stocks by the American Smelters Securities Co., guarantees of such stocks and purchases by the Smelting company, and the sale by the Guggenheim Exploration Co. to the Smelting company in 1911 of substantially half of the common stock of the Securities company. Reference is also specifically made to the transfer to Guggenheim Brothers in 1921 of the copper-selling agency which the Smelting company had conducted for ten years.

Election of a board of directors of whom a majority would be independent of the present management has been advocated by the majority members of the committee in a statement to stockholders.

A call for proxies has likewise been sent out by the management.

Elihu Root Comments on Report of Majority

Elihu Root, who examined the majority report for the company in place of Mr. Taft, cites the dividend record, showing that the stockholders in twenty years have had returned to them the entire cash investment, plus 6 per cent per annum, plus $23,000,000 in excess of the entire cash investment and annual interest thereon, and that they now have behind their stock practically a clear value of more than $128,000,000, equivalent to par for both common and preferred stock and $17,000,000 surplus.

Taking up the points of criticism referred to by the committee in its report, Mr. Root says:

"The consideration moving from the Smelting company for its half of the Smelters Exploration Co. common stock was its guaranty of $7,500,000 of the Smelters Exploration Co. preferred stock. It is objected that the properties conveyed to the Smelters Exploration Co. under this arrangement were not such as to justify an expectation that the profits from their operation would pay the dividends on the preferred stock and leave any margin for the common stock. It is unnecessary to discuss this objection, because the actual operation of the properties has proved the contrary."

Referring to the organization of the American Smelters Securities Co., Mr. Root says that the criticism is that the American Smelting & Refining Co. should have financed the new copper smelting development itself alone, taking all the profits itself, instead of bringing in the Smelters Exploration Co. to take part in financing and carrying on the enterprise and in the profits. Defending the management against this, Mr. Root says in summarizing:

"The gist of the matter was that the Smelting company was not in a financial position to raise the money for the new enterprise without taking Mr. Schiff and his associates into a virtual partnership with them in the enterprise. That was the conclusion reached, and accordingly the issue of Preferred B stock with the guaranty of the Smelting company was increased from $7,500,000 to $30,000,000 and the stock was taken by an underwriting syndicate formed by Kuhn, Loeb & Co. and very largely made up of Mr. Schiff's associates and customers."

As to the transfer of the copper-selling agency, Mr. Root summarizes thus:

"The so-called transfer of the selling agency comes down to this: That the agency was brought to the company through the influence of Messrs. Guggenheim in the producing copper companies; that it remained with the Smelting company so long as it was beneficial and productive of great profits to the company and until the company was forced to discontinue the agency because they could not continue it without ruin; that upon the happening of that event, the Guggenheims, in discharge of their obligation to the stockholders of the copper producing companies, entered into a new arrangement for the sale of their copper, not for profit, but for the best interests of all concerned, the Smelting company included."

Mr. Root concludes that the management is not subject to just criticism upon either point, but is "entitled to high credit for its devotion to the interests of the company and the fairness and integrity of the management." He also says that the report and annexed material contain no charge or suggestion of graft or dishonesty or peculation in the management, or in the multitude of employees of the company.

Minority Upheld Management

In giving their reasons for disagreeing with the majority, the minority state, in part:

"The Messrs. Guggenheim are entitled to a very large share of the credit for the company's prosperity, not alone by reason of their participation in building up the 'valuable organization' which now operates the business, but primarily by reason of the fact that they have consistently brought to the company the ores of the mines in which they have been interested.

"There can be no question but that the good offices of the Messrs. Guggenheim enabled this company to procure the business of the Utah Copper Co, the Kennecott Copper Corporation, the Nevada Consolidated Copper Co., the Braden Copper Co. and a number of other important companies.

"The profits arising in the past twenty years from the contracts and business which have been thus brought to the company have been very great. The contracts with these companies have been as favorable to the Smelting company as the contracts with other companies in which the Messrs. Guggenheim have had no interest whatever.

"Much is said in the report concerning the profits of the Copper Sales Agency, which was terminated in 1920. The Sales Agency could not have been retained without causing serious embarrassment and loss to the company, and it has since been demonstrated that its earnings, even if it had been retained, would be comparatively unimportant.

"But the majority report makes no mention of the fact that the Messrs. Guggenheim are entitled to the credit of having brought to the company in the first instance this agency and the profits it yielded prior to the period of war readjustment and consequent financial crisis, which necessitated its termination.

"In our opinion, the 1905 transactions, about which so much is said in the report, are transactions in which the Guggenheims' personal interest lay with the American Smelting & Refining Co. as against the Guggenheim Exploration Co.; and viewed in this light, we think the 1905 transactions cannot properly be criticized, especially as they turned out to be highly profitable to the Smelting company."

Appeal in McDougall vs. Oliver Iron Mining Co. May 30

On May 30 the appeal of Alexander McDougall from the decision of Judge Wilbur F. Booth, in the case of Alexander McDougall vs. Oliver Iron Mining Co., will come up in the U. S. Circuit Court of Appeals in St. Paul, according to schedule. McDougall sued the Oliver company for alleged infringement of ore concentrating machinery.

Gold Ore Discovered in Java

By Cable from Reuters to "Engineering and Mining Journal-Press"

Batavia, May 5—A discovery of gold ore is reported in the Soekaboemi district of Java.

Ice Breaking Up on Yukon

The ice began to break up on the Yukon River on May 14, and the event was celebrated at Dawson, Y. T., in the usual manner. An influx of miners and prospectors is expected in the Mayo district during the present summer. The White Pass Railway Co., which for many years has run an excursion from Vancouver to see the midnight sun, has had to suspend it this year because it has such a heavy booking of ordinary traffic.

A large amount of building supplies has been assembled at Whitehead for shipment to Mayo Landing as soon as navigation opens. The Yukon Gold Co. has 3,300 tons of high-grade ore at Mayo Landing, ready to be shipped south.

News from Washington

By PAUL WOOTON
Special Correspondent

Bitterness Marks Tariff Debate

Proposal to Increase Rate on Barytes Causes Argument—Walsh Explains Position on Manganese.

Indications of the acrimonious character of the debate certain to take place in the Senate when the metal schedule is reached were in evidence during the consideration of the committee amendments to the chemical schedule of the tariff bill. Several items in that schedule are of immediate interest to the mining industry. In addition to the economic cleavage between members as to the advisability of a duty on cyanide, a political element has been injected into the discussion. To an already taut situation there has been added outbursts of partisan bitterness.

While the paragraphs dealing with lead pigments and salts of zinc were approved as amended by the Finance Committee, the discussion foreshadowed what may be expected when the lead and zinc paragraphs are reached.

The committee's proposal to increase the rates on barytes ore to $10 per ton and on *blanc fixe* to 1¼c. per lb. precipitated extended debate, and the paragraph went over for later consideration. Senator Walsh, of Montana, sees no reason for a heavy duty on barytes when manganese is put on the free list. His position with regard to a duty on manganese is set forth in a letter to one of his constituents, as well as by his remarks on the floor.

"I intend to see that the facts upon which the people of Philipsburg insist upon a duty on manganese are fully presented to the Senate and their right to it on the theories of those supporting the bill is vindicated," the Senator says in a letter to W. W. Williams, manager of the Moonlight Mining Co., of Philipsburg, Mont. "If there is to be a heavy duty on barytes, for instance, there is no reason why there should not be a duty on manganese, the fact that the latter is consumed by the great steel companies, while the former goes into products of less prodigious manufacturers, being no very sound reason. I shall vote against the proposal of the Finance Committee to transfer manganese to the free list. What I meant by saying that I should not vote for a duty on manganese is that I shall not vote for the bill in order to get a duty on manganese or because it carries a duty on that commodity."

The Senator has pointed out on the floor of the Senate that to get a duty on manganese he must not only vote for the bill but must vote for a multitude of indefensible duties. Though he would like to see the manganese mines at Butte and Philipsburg at work, he does not want to pursue a policy likely to shut down the copper mines in Butte to attain that end, he stated.

The lead pigments and litharge duties were passed over until the Senate passed on the lead duty, which was subjected to much criticism. Senator Jones, of New Mexico, opposed increasing the lead content of ore duty 100 per cent and the pigment duties 315 per cent. He stated that although the duty was imposed for the benefit of producers of lead ore, the imports of lead ores are from Mexico and are controlled by the same concerns which smelt the product in this country. Senator Smoot said the duty was to cover the smelter charges on which there were losses, and also the extra cost of materials in smelting as compared with smelter costs in foreign countries. Senators Jones, of New Mexico, and Walsh, of Massachusetts, argued that the duty would not protect the American lead producers, as lead would be brought in free contained in copper matte. Two thousand tons of lead in copper mattes it is proposed to admit free.

Senator Jones, of New Mexico. opposed the duty on lead, saying there was no necessity for placing a tariff on lead except the ore itself. Under existing circumstances, he said it was all right to levy a duty on the lead ores which may be imported. He argued that the lead-bearing ore producers are at the mercy of the smelters, as they are required to sell their ore to the smelters, and the benefit to the actual producer of ore is uncertain. He stated that lead-bearing ores can be produced in Mexico for less than in the United States, owing to the formation in which the lead appears and the labor situation.

Senator Caraway, of Arkansas. said the importation of 2,000 tons of lead ore in copper matte was a "present of $60,000 a year to the smelting companies."

Senator Smoot, of Utah, defended the duties, pointing out that as it did not pay to take the lead out of the copper matte the companies smelting the ores should not be penalized by a duty on the copper matte containing lead that they cannot recover at the market price. He said the Colorado smelters had been closed and the plants of the American Smelting & Refining Co. transferred to Mexico because of the transportation charges in this country. Senator Smoot said the business of three smelters had been transferred to Mexico. Senator Jones said the Western smelters had an advantage in smelting dry metallic ores. He did not think the lead industry was in such a depressed condition, and said the reason the Colorado smelters were closed was because of depression in the gold and silver industries.

Government's Silver Purchases

Purchases of silver by the Bureau of the Mint during the week ended May 20 amounted to 289,400 fine ounces. This brings the total purchases under the Pittman Act to 110,373,756 fine ounces.

War Minerals Relief Commission Continues Work

Numerous Claims Allowed—Disallowances in Fifteen Cases

Among the awards recommended by the War Minerals Relief Commission are the following: E. A. Garrison, Forest Hill, Cal., $1,540.75; Fred Kohlmeyer, Deming, N. M., $1,414.71; Green, Mattos and Volonte, Castella, Cal., $806.64; August Dupzyk, Hornbrook, Cal., $187; C. H. Hawkins, San Francisco, $824.76; Caldwell and Albrecht, San Francisco, $1,428.85; Albrecht, San Francisco, $1,428.85; Smith, Starr, and Grunnell, Grants Pass, Ore., $270; Alex E. Hook, Stockton, Cal., $888.70; Continental Mining & Royalty Co., Mena, Ark., $395.78; Allen-Odea Ore Co., Birmingham, Ala., $993.85; C. H. Hawkins, San Francisco, $867.51; Willis A. Sharp, Grants Pass, Ore., $1,085.82; estate of Frank L. Shelby, Brookdale, Cal., $2,361.85; estate of Charles Sisson, Boulder, Col., $285; James W. Duckworth, Sumpter, Ore., $466.17; Joe Meadows, Sumter, Ore., $466.17; Frank Rose, Talent, Ore., $593.24; George J. Sherman, Salt Lake City, $162.63; F. A. Emerald, Salt Lake City, $233.63; and C. A. Kirkland, Salt Lake City, $222.63.

Disallowances have been recommended in the following cases: Robert Brown, Elko, Nev.; Mrs. Dorothy Moffitt, Gillette, Wyo.; J. A. Faucher and A. S. Hughes, Oakland, Cal.; Robert E kelman, Custer county, Col.; O. G. Avery, Fresno, Cal.; Paramount Metals Co., Cleveland, Tenn.; H. Sordy and C. E. Noble, Grants Pass, Ore.; A. E. Hanenkrat, Prairie City, Ore.; V. E. Gillette, Prairie City, Ore.; P. F. Renfroe, Cartersville, Ga.; John Buchanan, Prairie City, Ore.; Vindicator Consolidated Gold Mining Co., Denver; Mines Efficiency Co., Duluth, Minn.; Southern Sulphur Ore Co., Nashville; Thorkildson and Miller, Los Angeles.

Ewert's Title to Indian Lands Void, Supreme Court Holds

Titles to lead and zinc lands acquired by Paul A. Ewert from Oklahoma Indians in 1909 are invalid because Ewert was at the time employed by the Government as a Special Assistant Attorney General in Indian land matters, according to a decision of the U. S. Supreme Court rendered on May 15 by Justice Clarke. The court sustained the Circuit Court of Appeals for the Eighth Circuit, which invalidated Ewert's acquisition of the lands under a law of Congress forbidding persons employed in Indian affairs from having any interest or concern in any trade with the Indians except on account of the Government.

In one of the two cases decided by the court, it was held that not only did Ewert's acquisition of lands from In-

dian minors come within this prohibition but also lands acquired from Indian adults. In the second case decided the court held that the Indian from whom Ewert obtained the lands was incompetent to handle his affairs. The Supreme Court did not accept Ewert's defense that he purchased the lands at public sale by the Interior Department and that he had such a right as any other citizen.

Railroad Rate Reduction Now a Political Issue?

The President's dinner at which the railroad executives were guests is conclusive evidence to many traffic men that railroad rate reduction is now a political issue. It is believed generally in Washington that the President called in the railroad executives after he had learned that the Interstate Commerce Commission could not at this time reach a conclusion to order substantial reductions in freight rates.

There is a tendency to criticize the commission for its failure, after more than five months of consideration, to get together on a definite finding, rather than to create a situation where the President practically has been forced to take a hand in rate making.

Action on "Blue-Sky" Bill This Session Unlikely

The Senate Committee on Interstate Commerce plans to give hearings on the Denison "Blue-Sky" bill at a later date, in response to numerous requests from various parts of the country. Action on the bill will probably not be taken, however, this session, because of the desire of Congressional leaders to adjourn after the tariff bill reaches final disposition.

Child Labor Bill Introduced

A bill making it unlawful to place in interstate commerce the product of any mine or manufactured article in the production of which the labor of children under fourteen years of age has been used, without notice of such fact being conspicuously placed thereon by tag, marker or other means, has been introduced in the House by Representative Huddleston, of Alabama. Administration of the law would be under jurisdiction of the Interstate Commerce Commission.

Coal Price Conference May 31 at Washington

To make effective a plan intended to prevent a runaway market in coal, a general coal price conference has been called by the Secretary of Commerce to be held in Washington on May 31. This announcement by Secretary Hoover followed a preliminary conference on May 18 at which fifty operators, representative of all the non-union fields, voted to use the Garfield schedule of prices of Oct. 29, 1917, as a basis for fixing fair prices of coal.

News by Mining Districts

London Letter

Aid for Cornish Tin Mining—Government Gold Mining Areas Consolidated Shows Profit of £1,803,486

BY W. A. DOMAN

London, May 9—Though down on their luck, owing to the low price of tin, Cornish miners have ever looked forward to a revival of the ancient and main industry of the Duchy. They have experienced bad times, and, much to their disappointment, have been compelled to accept doles. Money has been subscribed to enable these unfortunate miners to live, but the fund is rapidly becoming exhausted. The outlook now is rather more hopeful, for after long negotiations the Trade Facilities Committee has decided to assist the South Crofty to the extent of £30,000. This will enable work to be carried on for considerable time, and will give a fair amount of employment. It is expected, too, that the Trade Facilities Committee will decide to give assistance to the Levant mine, which works under the Atlantic. Even this is not all, for William Hosking, the president of the Institute of Mining Engineers, has brought forward a proposal for an amalgamation of the mines in the Camborne district. The negotiations have proceeded so far that a London syndicate is prepared, on conditions, to put up £500,000 to resume operations.

There are, of course, pessimists still in existence, and one of the largest firms in the tin business talks rather dolefully of the prospects. The stocks of the metal are reported to be about 35,000 tons, in itself not excessive, except for the fact that trade is bad. If the tin-plate industry could get going, there would be no difficulty in disposing of this quantity, and then prices might improve.

The Government Gold Mining Areas (Modderfontein) Consolidated still maintains its reputation as one of the big mines of the Witwatersrand. During the last calendar year it crushed 1,625,500 tons of ore, for a revenue of £2,828,220, with gold at standard price; but taking £5 5s. 9d. per fine oz., which was realized, and adding sundry revenue, the total income was £3,561,397. Working expenses took £1,757,911, leaving a working profit of £1,803,486. Of the profit, the Union Government took 49 per cent, or £896,211, and, in addition, the company paid in taxes £17,051. Shareholders received in dividends £770,000, or 55 per cent on the capital, which is £126,000 less than the government share. This is explained by the fact that instead of the company paying for mining rights, the government gets a percentage of the profits. Working expenses per ton were just under 21s. 8d., a reduction of about 6d. per ton, due partly to an increase of 110,000 tons crushed and partly to a reduction in white wages, and the working profit was 13s. 2d., in comparison with 11s. 8d. The amount received for gold above the standard price was £692,181. Considering the conditions, working costs were low, though if the government would reduce railway rates the figure might be brought down to a round sovereign per ton. The revenue per ton at standard price was nearly 34s. 10d., an increase of about 1s., due to a larger percentage of waste sorted out, and to the quantity of ore obtained from reclamation work.

As regards development, a lower footage was done on the reef, 16,352 ft., against 19,905 ft., and the proportion payable was 59.6 per cent, against 66.1 per cent, the average value being 13.5 dwt. over 57 in., in contrast with 14.6 dwt. over 55 in. Although such a large tonnage was extracted, the ore reserves remain at practically the same figure as a year earlier—namely, 10,232,000 tons, of an average value of 8.5 dwt. over a stoping width of 77 in., the gold content being higher by 0.3 dwt. As these reserves include ore of a value of 4 dwt. and over, it is evident that some of it is, for the Rand, distinctly rich. All the development to the west of the mine has been good, but in the opposite direction it was not so satisfactory. A circular shaft with an inside diameter of 22 ft. is to be sunk to a depth of 3,500 ft.

BURMA

Burma Corporation Reports April Production

Namtu—In April, 15,842 tons of ore was milled by the Burma Corporation, producing 9,695 tons of lead concentrate; 10,420 tons of lead-bearing material was smelted in the blast furnaces, producing 3,361 tons of hard lead for treatment in the refinery. Refinery products were 3,029 tons of refined lead and 320,767 ozs. of refined silver.

Coronation Syndicate Reports Gold Discovery

Capetown, May 19—The Coronation Syndicate's report on the Luipaards Vlei Estate & Gold Mining Co. says that a Randfontein leader three and one-half inches wide has been cut at a depth of 785 ft., assaying 11¼ dwt. over a width of 48 in.

Would Revive Mining Industry in New South Wales

By Cable from Reuters to "Engineering and Mining Journal-Press."

Melbourne, May 17—In view of the serious mining depression in New South Wales, the Minister of Mines has invited various interested bodies to submit plans to restore the industry.

Johannesburg Letter

Two Green Diamonds Found—Coronation Syndicate Holds Meeting—Gold Output for First Quarter Less Than for Normal Month

BY JOHN WATSON

Johannesburg, April 18—The gold output of the Transvaal for the three months ended March 31 was declared on April 12 by the Chamber of Mines. The total for the three months is from 70,000 to 80,000 oz. less than the average for a normal month. The figures were: Witwatersrand, 594,788 fine oz.; outside districts, 44,940 fine oz; Transvaal total equaled 639,728 fine oz. Owing to the long duration of the strike, no comparison is made with previous months, nor is the value given of the output, owing to the difficulty of arriving at an average price for the gold produced over the period of three months. The largest producers were: Government Areas, 56,004 oz.; Crown Mines, 53,104; and New Modderfontein, 40,406 oz.

The following figures, given by the Minister of Mines, show to what extent work on the gold mines is being resumed. Since the strike was declared off and to March 31, approximately 7,500 Europeans had been re-employed, whereas about 6,500 had applied for work without success. The number of natives who had returned to work was 2,116. The total numbers employed on March 31 (including officials and those who have worked on essential service) was 12,639 Europeans and 123,526 natives. Permission to reopen recruiting of natives was wired to Union native areas on March 18 and to Mozambique on March 27.

Two discoveries of green diamonds have recently been reported. The first, found in the Bloemhof district, was a 5½ carat stone, black and opaque, which, on cutting, yielded a jewel of 1⅛ carats of an emerald-green shade. It has been valued by London experts at about £5,000, or about 100 times the price of a water-white diamond. The second green diamond was washed out at Parys a short time ago, and was of 10 carats weight. It has been sent to a government valuator at Cape Town. One of the most celebrated green diamonds is the "Dresden Green," in the Saxon Crown jewels, which weighs about 40 carat and is apple-green in color.

At a special meeting of shareholders of the Coronation Syndicate, Ltd., held in Johannesburg on April 6, it was stated that a number of influential firms in London and Paris had agreed to underwrite an issue of £100,000 cash, which will be offered to shareholders for subscription. Coronation Syndicate shares are now selling at about 5s. The company holds 1,000 claims near Balfour, where reefs have been proved in two shafts. It holds nearly 16,000 shares in the Afrikander Proprietary Gold Mines, Ltd., in the Klerksdorp district. It has an interest in the Machavie Gold Mining Co., Ltd., and it owns a freehold farm, Zonnestraal, (277 morgen) in the Heidelberg district. It holds an option to take over the mining lease on Luipaard's Vlei, No. 10, on the West Rand, where two bore holes (out of three sunk) have disclosed the Randfontein series of reefs.

The Union Corporation, Ltd. (formerly Ad. Goerz & Co.) accounts for the year 1921 show a realized net profit of £179,517. The directors have decided to add £30,000 to the reserve account and have declared a dividend of 16 per cent (2s. per share), involving an amount of £140,000 and leaving the sum of nearly £78,000 to be carried forward.

The newly formed Mining Industry Commission proposes to begin its sittings in Johannesburg on April 24, at the New Law Courts.

CANADA

British Columbia

Iron-Ore Resources of Province To Be Surveyed This Summer

Victoria—A survey of the iron-ore resources of British Columbia is to be started this summer. The Canadian Geological Survey Branch has agreed to undertake this work, in co-operation with the Provincial Department of Mines. The object is to obtain information as to the ability of British Columbia to support an iron and steel plant of large capacity. Dr. G. A. Young will begin the field investigations within a few weeks.

The Cedar Creek placer gold discoveries are taking hundreds of men from Victoria, Vancouver, Seattle, and other Pacific Coast cities. Though the snow has not entirely disappeared, work has begun on some of the claims. Platt and Lyne, owners of Discovery, state that their property is not for sale and that it will be developed this season.

Ontario

Coniagas Gets Control of Newray—Dome Directors May Propose $2 Capital Repayment

Cobalt — Under an agreement between Newray Mines, of Porcupine, and Coniagas Mines, of Cobalt, which was ratified by Newray shareholders at a special meeting May 16, Coniagas has secured control of Newray and an option on the balance of the treasury shares. The option covers the total of 1,530,000 shares in the treasury, at 35c. a share. Coniagas contracts to spend at least $4,000 a month. The shaft is now down 400 ft. Work will be started within two weeks. F. D. Reid, manager of the Coniagas, will be in charge of operations.

F. L. Culver, of the Beaver Consolidated, says that though the Beaver will soon be in good condition for resuming mining and milling operations, no definite date has been set.

The Temiskaming directors want to see silver solidly at 80c. an ounce before talking of reopening.

Operations at the Castle-Trethewey, of Gowganda, continue satisfactorily, and it is said that the mine is now on a self-sustaining basis. Sufficient high-grade ore is being bagged from work on the new vein at the 260 level to pay all operating charges. Considerable mill rock is also being developed.

La Rose may appeal to the Privy Council in connection with the recent judgment in the dispute regarding the Violet and O'Brien boundaries, which gave the main Violet shaft to the O'Brien.

Kirkland Lake — New York capital has secured control of the Munro-Kirkland company, buying out some of the larger interests and securing options on smaller holdings. It is proposed to complete the assessment work on some claims not yet patented. The company owns about ten claims. After this work is completed, it is proposed to do some diamond drilling in an effort to prove continuation of the veins found on the Lebel lode, which lies to the west.

Porcupine — According to present plans of the Kerr Lake management, sinking at the Goldale property, near the McIntyre, will start June 1. The shaft will be sunk to the 500 level before lateral work will be undertaken.

It is said that the policy of the directors of the McIntyre is to spend a considerable sum on the development of the mine's ore possibilities and a continuation of the intensive campaign of the last two years rather than to increase the dividends.

According to a current report, at an early meeting of the Dome directors it will be proposed that Dome's second repayment of capital, which is to be made this year, be $2 a share, instead of the expected $1. The production figures for the last four months are as follows: January, $300,000; February, $307,000; March, $312,000; and April, $377,000. These official figures clearly show that the company has been realizing net profits at the rate of over $200,000 a month since the beginning of the year, or at the rate of over $5 on each issued share.

Port Colborne—Operations at the nickel refinery of the International Nickel Co. of Canada at Port Colborne are being increased, and the directors have ordered an additional furnace to be started. Numerous orders are being received, and the output is to be increased to about 1,000,000 lb. per month. President J. L. Agnew stated in answer to inquiries as to when work would be resumed at the smelter at Copper Cliff that the company expected to have it in operation early in the fall, but the date had not been decided.

Goudreau—The country surrounding the original gold discovery now being developed by the Goudreau Gold Mines, Ltd., has been widely staked, over 1,600 claims having been recorded during the last eight months. The staked area covers about 360 square miles, the belt being thirty miles long and twelve broad. About ten syndicates have been formed.

MEXICO

Government to Study Mining Industry in Order to Rectify Abuses—No New Titles Until Old Have Been Annuled

Mexico City—The Secretary of Commerce and Labor is preparing to appoint a series of committees, in different parts of the country, for the purpose of making a careful study of the mining industry, with a view to getting recommendations that will enable the government to rectify certain abuses which are complained of, and to assist in building up the industry.

Two questions of vital importance will be given special attention: (1) The tendency on the part of certain state authorities to pass laws, under the pretense of benefiting labor, that threaten completely to paralyze the industry locally; (2) to bring pressure on the railway managements for a more equitable traffic rates. At present, a few of the larger corporations do enjoy large reductions, but the smaller concerns and the individual miners are seriously handicapped, and in many instances prevented from doing development work and conducting exploitation operations by excessive freight charges. In fact, in many instances they are placed entirely at the mercy of the smelters.

It is also intended to recommend a reasonable tariff reduction on many of the articles of prime necessity which are used in the development of the mines, and which of a necessity must come from abroad.

The department has expressed its sympathy with the reform work, and appears to be anxious to encourage miners to get to work.

A commission from Chihuahua has been in the city several days attempting to get a hearing from the federal authorities so as to explain its objections to several clauses of the new labor laws of Chihuahua, which it is claimed will paralyze mining operations in general. Efforts to get a suspension of the law from the governor of the state have been ineffectual. As a result of the governor's attitude, it is reported that several properties have suspended work. The Chihuahua Chamber of Commerce has made a vigorous protest.

Mexico still leads the world in silver production. The Department of Industry has given out the March production as being 209,346 kg., against 181,183 kg. produced in February. The gold output for March was 2,091 kg. and for February 1,778 kg.

To eliminate the difficulties hitherto encountered by owners of mines in redeeming their titles, ordered canceled by the Finance Department in view of taxes due and unpaid, the Secretary of the Treasury has ordered that in the future no new titles will be issued by the Department of Commerce unless that department is notified by the Secretary of Finance to annul the old titles. Until recently it has been the practice of the Department of Commerce to annul old titles and issue new ones as soon as it was advised by the Finance Minister that taxes were delinquent. Owners have often found their titles in dispute without notice having been given them previously of cancellation of titles.

NICARAGUA

Matagalpa—J. A. Willey has taken over the Las Encinas claims in the Segovia district.

The San Albin mine, about 15 miles away, is owned by Charles Butters, who is erecting a plant, consisting of sixty-ton mill, and a small smelter. This is the first of the kind in Nicaragua.

CALIFORNIA

Use of Tule Lands for Disposing of Debris from Hydraulic Mining Advocated.

San Francisco Correspondence.

San Francisco—Recently, at Grass Valley, W. H. Martin advocated Government aid in bringing about a resumption of hydraulic mining on a larger scale than at present. Mr. Martin suggests the use of existing river channels and the flooding of the waste tule lands with the debris. The plan is in opposition to the present system, which requires the construction of local restraining barriers. Owing to the stand of the farmers the suggested plan is not likely to be seriously considered, although it is held to be not without some merit.

Suit has been filed in the U. S. District Court by the Original Sixteen-to-One Company against the Mariposa Mining Co. which has acquired the Ophir mining property, in the Alleghany district. Two suits have been started, one to quiet title and the other for damages. Extralateral rights are the issue involved.

The opening of the highway down the Klamath River between Happy Camp and Orleans Bar makes the lower Klamath country more accessible and may result in additional lode mining.

The South Fork of the Feather mine, near Woodleaf, Yuba County, is again being worked.

The Gruss Mining Co. has taken over the Surcease mine, near Las Plumas.

Near Kelsey, El Dorado County, the Harlow North Star Gold Mining Co. is developing a quartz vein.

At Angels Camp, reports are in circulation to the effect that W. J. Loring will soon begin operations on the Chaparral Hill group.

At Jackson, the Amador Tunnel Mine & Milling Co. has withdrawn the demurrer in a suit to quiet title to certain mining property situated near Middle Bar and also the Mammoth Gold Quartz mine. Hydraulicking at the Elephant Deep Gravel mine is expected to be completed within a month, and other sections near Volcano will be attacked.

Randsburg—There are at present thirty-five shafts in active operation, sinking, developing, or producing.

A 5-in. rotary core drill is prospecting the Hard Cash claim of the Yellow Aster. The Kelly Rand mine has struck good ore at 250 ft. The Mizpah Montana encountered high grade at 100 ft. The North Rand is prospecting on the third and fourth levels, and has found some high-grade stringers. The Coyote (Randsburg Silver Mining Co.) is sinking three shafts on the ground recently bought. Grady is sinking two shafts, one of which is now 600 ft. deep.

About 500 men are employed in the district. Mines have been bonded by substantial companies, and there are indications that the known productive area is only a small part of the area that will eventually be productive.

The Yellow Aster is dropping twenty stamps and remodeling its screening plant.

NEVADA

Pioche Consolidated Stockholders Vote New Bond Issue—Conditions Normal at Tonopah

Rochester — Production in April of the Rochester Silver Corporation was 4,540 tons, with a gross value of $46,768, which is below normal. Profit was small, on account of extensive development work.

Peavine — The water struck during the latter part of April in the Standard Metals mine has been bulkheaded and development resumed.

Leadville—The Leadville Mines Co. resumed milling on May 6. The mill was not operated during the winter, on account of adverse weather, but development work was never stopped. The vein on the 400 level is 8 ft. wide, with 7 ft. of milling ore and 1 ft. of high grade on the hanging wall.

Tonopah—Conditions in this district are normal, with a daily production of about 1,300 tons. The Tonopah Belmont, which has a lease on the Buckeye Belmont ground, is preparing to sink the shaft below the 1,200 level to prospect a vein cut in the shaft near the 1,200. In addition, some development work is being done on upper levels.

The Tonopah Extension has resumed sinking the Victor shaft below the 1,880 level. It is planned to sink to the 2,100 level, with stations at the 2,000 and 2,100 levels. The oreshoots are exceptionally strong and rich on the 1,880, or lowest present level, with no indication of decrease with depth.

Goldfield—During 1921, the lessees at the Goldfield Consolidated shipped 2,400 tons of ore. To date this year, 1,500 tons of ore has been shipped, and the grade is considerably better than in 1921. Most of the recent ore shipped has come from the Silver Pick lease, in Red Top ground, although one leaser in other ground has shipped 67 tons which averaged 17 oz. gold per ton.

Pioche—Stockholders of the Prince Consolidated Mining Co. met in Salt Lake City, May 15 and voted to issue $150,000 of 8 per cent bonds or debenture notes, maturing three years after date. A bonus will also be given in stock.

MONTANA

Hawkesworth Removable Drill Bit Tested—Silver Dyke Incorporated in Montana—Davis-Daly May Resume June 1

Butte—At Butte, tests have been made with the new Hawkesworth drill point by the Anaconda company. The company is making arrangements to manufacture at Anaconda points for use in its mines. A demonstration was made recently for the benefit of the operating officials of other mining properties.

The Hawkesworth point weighs about four ounces and is made of vanadium steel. It is attached to the steel shank by a groove so made that the harder the point is driven into the rock the more firmly the point maintains its grip on the shank. When dulled, the bit can be displaced from the shank by a blow of the hammer, a sharp bit slipped into the shank groove and the drill started again with only a moment's loss of time.

The demonstration recently made took place at the St. Lawrence mine. An ordinary drill 1¾ in. in diameter was used. In two minutes the point penetrated the granite for 9½ in. One of the Hawkesworth points was substituted, and at the end of two minutes the drill had penetrated 20½ in. A second test of a point that had been ground down in resharpening to 1⅝ in. showed the rock penetrated for 22 in.

It was pointed out that, besides the advantages in drilling that the new drill point achieves a large saving can be effected in other ways. Starting on shift, all that a miner needs is to carry four shanks at the most, with a supply of sharpened points in his pocket. As fast as one point becomes dulled, another can be substituted. This makes unnecessary the hoisting of huge quantities of steel to the top every night to insure a fresh supply for the next day's operations.

Articles of incorporation of the Silver Dyke Mining Co., a subsidiary of the American Zinc Co., have been filed in Cascade County, giving the company authority to do business in Montana, it being a Maine corporation. The company owns thirteen mining claims in the Neihart district. According to recent reports from that district, the Silver Dyke has opened up a body of good milling ore.

Though no actual information has been received at the Butte offices, it is anticipated that the Davis-Daly mining company will resume work at the Colorado mine about June 1. It is expected that by then a new contract with the East Butte company for smelting Davis-Daly ores will have been ratified. It is understood that the new contract is advantageous to the operation of the Davis-Daly property.

Transvaal's Gold Output Reported

London, May 22 — The Transvaal Chamber of Mines advises that the total gold output in the Transvaal during April totalled 511,338 ozs.

UTAH

Utah Consolidated Increasing Scale of Operations—Tintic Standard to Locate Third Shaft

From Our Special Correspondent.

Bingham — Operations are to be gradually increased by the Utah Consolidated. It is expected that the new 1,000-ton mill at Tooele will be working at capacity in June. Ore from the property at Bingham will be sent to the mill by aerial tramway, over a distance of four and a half miles. During the period of curtailment, improvements in equipment and operating arrangements were made. Exploration work on the lower levels of the mine was continued. On the 2,200 level east, the main oreshoot in the upper limestone was drifted on for 227 ft., averaging 2.7 per cent copper, .013 oz. gold, and .46 oz. silver. On the 2,400 level, the same oreshoot was followed 52 ft., and the assay was 2.2 per cent copper, .02 oz. gold, and 1.77 oz. silver.

Eureka — Shipments for the week ended May 13 amounted 173 cars. Shippers were: Tintic Standard, 56 cars; Chief Consolidated, 50; Grand Central, 15; Colorado, 14; Iron Blossom, 10; Eagle & Blue Bell, 9; Victoria, 7; Empire Mines, 4; Centennial-Eureka, 3; Sunbeam, 2; Bullion Beck, 2; Showers, 1.

The Tintic Standard has acquired a large rotary drill. This will be used in prospecting ground lying to the northeast of the No. 2 shaft, and will furnish data for the sinking of a third shaft.

Park City—Shipments for the week ended May 13 amounted to 2,119 tons of ore. Shippers were: Silver King Coalition, 855 tons; Park-Utah, 250; Ontario, 388; Judge, Daly, and Daly-West, 627.

COLORADO

Production in Boulder, Gilpin and Clear Creek Counties Increased—Conditions in Alma District Better

From Our Special Correspondent.

Denver—A survey that has recently been made by the Colorado Metal Mining Association to ascertain the present and probable future production of smelting ores in Boulder, Gilpin, and Clear Creek counties indicates a decided revival of mining activity throughout the district mentioned. The survey was made for the purpose of procuring dependable data to present to the head officials of the railroads and smelters as a basis on which to formulate a readjustment of transportation and treatment rates so as to encourage an increase of tonnage of ores from the northern mining counties.

The figures show that there has been an increase in production of over 100 per cent since Jan. 1 and that projects under development and construction will increase the output several fold within the next six months.

A material reduction in both smelting and freight rates is expected within a short time, and this will still further increase the shipment of smelting ores to the Leadville plant.

Coal production in Colorado for the month of April, according to the report of State Coal Mine Inspector Dalrymple, amounted to 400,963 tons, compared with 644,868 tons for the corresponding month last year and 980,000 tons for March, 1922. The total for the year is but 94,709 tons short of the amount mined during a like period last year. The strike appears to be practically ended in Colorado, and no trouble is experienced in any of the mining districts to procure miners where demands for the product justify the operation of the mines.

Alma—Mining conditions in the Alma district are improving with the disappearance of ice and snow from roads and trails. Much new development work has been planned.

ARIZONA

United Verde Experimenting With Heap Leaching—New Power Development Scheme

Jerome—United Verde has turned to heap leaching. Under charge of Joseph Irving, who installed the Dundee-Arizona experimental plant last year, there is being built up near the mouth of the Hopewell tunnel a 5,000-ton heap of sulphide ore containing 2 per cent or less of copper. The mine water, itself rich in copper, will be passed through the leach heaps before being conducted to the precipitation plant. June 1 is now set as the date for resumption of smelting at Clarkdale, with one reverberatory and one water jacket. The former is being warmed up. There is to be monthly production of 4,000,000 lb., about two-fifths the capacity of the works. About 300 men are being added to the company's force, to give a total strength of about 1,000. The ore consumption will approximate 1,400 tons a day. Steam shovel work is to be speeded up with a crew of 250 men.

United Verde Extension is maintaining a monthly copper production of about 3,000,000 lb., and employs nearly 600 men. Last month's output was 3,500,000 lb. The 1,700-level drift into Jerome Verde ground still has 100 ft. to go to get under the Maintop ore strike, but conditions on the way are reported favorable. By this drift a large addition was developed to the Extension's own ore reserves.

Globe—Old Dominion, Inspiration, and Miami are reported to have joined in the employment of Louis C. Hill as a consulting expert to check over plans that have been submitted by the Salt River Valley Water Users' Association, involving possible participation by the companies named in a power-development scheme that may cost $6,000,000. Mr. Hill was the builder of the Roosevelt dam, while an engineer of the U. S. Reclamation Service. The Roosevelt project, at Roosevelt and at several Salt River Valley points, now develops about 25,000 hp. It is proposed to add about 40,000 hp. by erection of a high dam across Salt River at Mormon Flat and by other hydro-electric installations on the stream.

MICHIGAN

The Copper Country

Ahmeek Makes Important Find of Mass Copper—Arcadian Continues in Rich Ground

BY M. W. YOUNGS

Houghton—Mass copper of unusual size has been found in the Ahmeek's mass fissure vein on the nineteenth level of No. 2 shaft. One piece, weighing fourteen tons, has already been removed and brought to surface. It was cut from the main mass by means of twist drills of a special design and length. These rotary drills will accomplish in a few days what took weeks and months to do in former years when hand chisels were used.

At the Calumet mill of Calumet & Hecla, eight heads are being operated. Eight furnaces at the smelter are also in operation. Production is gradually increasing as shaft repairs progress and men can be employed in actual mining. Rock shipments now run about 2,500 tons daily.

Isle Royale continues on a production basis of less than half of normal, but the output can be increased easily whenever the market price for copper warrants. Meanwhile it is engaged in an extensive opening program. Approximately 70 per cent of the vein exposed in No. 5 shaft is available for stoping, and in No. 6 shaft almost 60 per cent of the ground can be mined. No. 5 shaft is the chief producer. Isle Royale rock runs better than 18 lb. to the ton, and last year, for the limited time the mine was operated, the yield was brought up to 21.37 lb.

Arcadian Consolidated continues in the rich ground opened in the south drift, 225 ft. from the shaft, at the 1,100 level of the New Baltic shaft. The miners are now into this rich area for a distance of 25 ft. from the point of contact and there is no diminution in values. The north drift from the bottom level also continues in good ground.

Menominee Range

Bristol and Monongahela Shut Down—Bates Miners Strike

Crystal Falls—Operations have been suspended at the Bristol mine of the Bristol Mining Co. and the Monongahela mine of the Hollister Mining Co. Large stocks of ore on hand are responsible.

Iron River—The Berkshire mine of the Brule Mining Co. has added a night shift, thus increasing the force by eighty-five. The Munro Mining Co. is shipping steadily from its Rogers mine, where there is 85,000 tons in stock. Shovels have also been at work at other mines of this company on the range.

The miners at the Bates mine of the Bates Iron Co. refused to go underground this week unless a higher wage scale was granted. The surface crew remained at work. Most of the mines of the range have increased wages to meet the scale being paid by the Oliver Iron Mining Co., and it is thought that the Bates miners will also be granted an increase.

Iron Mountain—The Oliver Iron Mining Co. is now operating its Chapin and Aragon mines on full time. The wage scale remains the same.

Gogebic Range

Tentative Valuations on Mines Lower Than Last Year

Ironwood — Although working full time the mines of the U. S. Steel Corporation have not yet begun to ship ore to the docks. A reduction in ore freight rates by rail and water is awaited, which it is thought will more than offset the additional cost of stocking ore at present. A few years ago this cost about 10c. per ton.

The hearings of the Michigan State Tax Commission in the several counties of the iron ranges were attended by representatives of most of the mining companies operating there, and many pleas for lower valuations on mining property were made. L. P. Barrett, state geologist, on whose examinations and reports the valuations are based, admitted that for several years the mines in Michigan had made an average profit of only about four per cent on their assessed valuation.

At Bessemer the commission announced tentative valuations on the mining properties in Gogebic County totaling $47,915,266, a decrease of $951,142 from last year's figures. The decrease was due principally to depletion, but the small profits of 1920 and 1921 also had an effect.

The real ground on which the mining companies feel they are justified in complaining is that their properties are valued at full cash value while other property is not. The commission argued that there should be a reduction in the expenditure of tax moneys by the cities and towns. They made the statement that of the total amount raised by taxation the cities spent 36.33 per cent, the county 10.68 per cent, the highway fund 12.04 per cent, the schools 32.46 per cent, and the state government only 8.49 per cent.

MINNESOTA

Cuyuna Range

Skilled Labor Becoming Scarcer—Armour No. 2, Mahnomen and Portsmouth Mines Resume

Crosby—With the resumption of mining at two of the largest mines in the district the Armour No. 2 (Inland Steel Co.) and the Mahnomen (Clement K. Quinn & Co.), the unemployment situation of the Cuyuna appears to have received a "knockout blow"; in fact, some operators even report difficulty in finding enough experienced men to fill their crews.

The Armour, the largest underground producer in the district, employing normally 200 men, has taken on full crews, and is rapidly getting into full swing with shaft shipments, as well as completing shipments from stockpile. Ore production is being pushed at the Mahnomen open pit, and indications are that this property will be a steady producer throughout the season. Unwatering of the pit was recently completed.

Another promising move was the reopening of the Portsmouth mine by the Gordon Mining Co., a subsidiary of Coates & Tweed. The Portsmouth, an open-pit reserve of both manganiferous and iron-ore grades, has been idle since the fall of 1920.

At the Hillcrest mine, at Ironton, the operators have just put into service the newly installed Pomona pump at the recently completed drainage shaft. This pump is now handling all pit drainage, and drifting has been resumed in the drainage drift cutting the orebody to the north. Daily steam-shovel shipments are being made from this property, and one shovel is engaged in extending the stripping limits.

Riverton—John A. Savage & Co. have awarded a contract to the American Bridge Co. for furnishing and erecting the structural steel in the new screening and drying plant of the Sagamore mine. Construction of the plant is expected to be completed about July 1, and machinery installed and in operation soon after. The plant as now designed is rated at 75,000 tons per month capacity. Most of the open-pit product which will be treated at this plant is a manganiferous iron ore.

Ironton—It is reported that plans are being considered for unwatering and reopening the Cuyuna-Mille Lacs mine, a manganiferous ore property of the American Manganese Manufacturing Co., which has been idle since 1919.

JOPLIN-MIAMI DISTRICT

Golden Rod Company to Open No. 4 Mine and Mill—Circle Mine Shut Down

BY P. R. COLDREN

Joplin—Preparations are being made by the Golden Rod Mining & Smelting Co. to reopen its No. 4 mine and mill about June 1. The property has been idle for more than a year. Numerous improvements are being installed preparatory to the reopening, including the addition of six or seven Boylan cones, and the installation of oil-incased bearings throughout. The mill will have a capacity of approximately 1,000 tons when started. The company has been operating only its No. 4 mill, which is one of the largest in the district.

Approximately half a hundred homes in Picher were moved recently as a result of the need of the Eagle-Picher Lead Co. for a new tailings pond for its Netta mill. Work has been started on the pond, which will be 700 ft. square, approximately, and is situated right in the heart of the town.

The Connecticut Zinc Corporation has closed down its Circle mine, at Oronogo, after a few months of operations, following idleness of more than a year. It is understood that the property was losing money steadily and that a shutdown was decided upon until zinc ore prices improve. The mill is the largest in the district.

THE MARKET REPORT

Daily Prices of Metals

May	Copper, N. Y., net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L.	Zinc St. L.
18	13.125@13.25	30.25	31.00	5.50	5.35	5.125
19	13.25	30.625	31.50	5.50@5.75	5.35@5.40	5.15
20	13.25@13.50	30.625	31.375	5.50@5.75	5.375@5.40	5.15
22	13.50	30.00	30.875	5.50@5.75	5.40	5.15
23	13.50	30.00	30.875	5 50@5.625	5.40@5.45	5.15@5.175
24	13.625	30.25	31.00	5.50@5.625	5.40@5.45	5.20

*These prices correspond to the following quotations for copper delivered: May 18th, 13.375@13.50c.; 19th, 13.50c.; 20th, 13.50@13.75c.; 22d, 23d, 13.75c.; and 24th, 13.875c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

May	Copper Standard Spot	Copper Standard 3M	Copper Electrolytic	Tin Spot	Tin 3M	Lead Spot	Lead 3M	Zinc Spot	Zinc 3M
18	61⅞	62	67	150¼	151¾	24¼	23⅛	27⅛	27
19	62⅛	62¼	67½	152½	154	24⅜	23⅛	27¼	27
20	...	...	...	...	....	...	...	...	...
22	61⅞	62¼	68	150½	151⅞	24⅞	23⅜	27¼	27⅛
23	62⅛	62½	68½	149¾	151¼	25⅛	23½	27¼	27⅛
24	62¼	62⅝	68½	150½	152	25¼	23½	27½	27⅜

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

May	Sterling Exchange "Checks"	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London	May	Sterling Exchange "Checks"	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London
18	444½	99⅛	73⅝	37	22	444½	99⅛	73¾	37⅜
19	444½	99⅛	71⅝	36	23	444½	99⅛	72¾	36⅞
20	444½	99⅛	73¼	37⅛	24	444½	99⅛	72⅛	36½

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three-eighths of a cent premium.

Metal Markets

New York, May 24, 1922

Metal producers are decidedly optimistic over the general increase in metal prices. Improved business conditions at last seem to be reflected in the demand for the non-ferrous metals and minerals, and speculation is playing only a minor part in the business that has been done.

Copper

Copper has advanced more during the last week than for some time. The increase has been caused by a continued good consuming demand, though not exceptional, accompanied by a dearth of current supplies to meet it. Few producers have any May-June copper left, though it may be obtained at current prices from one or two sources. The demand has been general, though wire and rolling mills are the chief buyers. Brass makers are becoming more and more a factor in the market, however. Most of the copper sold has been for July-August delivery.

Saturday saw the last of the copper which was available at 13.50c. delivered. Today sales have been made as high as 14c. for small quantities, though one or two thousand tons could be picked up at 13⅞c., for practically any delivery.

Export demand has been about the same as last week, at advancing prices. The quoted price of the Copper Export Association, c.i.f. European ports, is now 14c.

Lead

The American Smelting & Refining Co. raised its official contract price from 5.35c. to 5.50c. New York, on Thursday, May 18.

The lead market continues to be upset, with regular customers of the principal producers able to obtain their requirements at large concessions from the prices generally quoted in the open market. Lead has been sold in New York during the week as high as 5.75c., but this price was not maintained after Monday, when one of the principal producers began selling freely at 5.50c. Much the same conditions have obtained in the Middle West. An important consumer reports having bought lead at 5.25c., St. Louis, although he could have broken up the lot and immediately resold at a 15-point premium. Many inquiries for July shipment have been made, but producers continue to refuse this business except at average prices. The demand for lead from pipe manufacturers and mixed-metal manufacturers and dealers has been the feature of the last few weeks, orders from these sources being considerably greater than they have been for a long time. The cable companies have also been in the market for lead recently. With the resumption of activity by the strikers at Perth Amboy, and a liberal attitude as to the release of stocks by certain Western producers, there is little likelihood of any great pinch for lead being felt. The market is strong and may gradually go higher, but consumers should not be stampeded into paying fancy prices without a thorough investigation. An undue inflation will almost certainly be followed by a midsummer reaction.

The pronounced backwardation in the London market is considered an artificial condition, and indicates a scarcity of spot supplies on the London exchange rather than a feeling that lead prices are to weaken.

Zinc

Galvanizing demand has supported the market, and the tendency is still upward. There is also a good demand from brass manufacturers for the higher grades of zinc. Metal is now being sold for June at the prices herewith quoted, but July deliveries command about 2½ points premium. An order for 2,000 tons has contributed to the strength of the market in the last day or two, and today several other inquiries were made. Zinc has been sold for export to the Far East, but European prices are no longer attractive.

Tin

The tin market has been quiet, and tin platers show no inclination to lay in appreciable stocks. Reports that Straits shipments would approximate 7,000 tons for May have had a somewhat bearish effect on the market. Tin does not seem to have responded at all to the advances made by most of the other metals, the meager advance made in the first three weeks of April not having been maintained. Forward deliveries have been available at approximately the same prices as have been asked for spot.

Arrivals of tin, in long tons: May 17, Liverpool, 50; 18th, Straits, 800; 20th, Straits, 600; 22d, Singapore, 50; Liverpool, 100; 23d, Singapore, 50.

Gold

Gold in London: May 18th, 93s. 2d.; 19th, 92s. 11d.; 22d, 92s. 11d.; 23d, 93s. 2d.; 24th, 93s. 4d.

Foreign Exchange

No important features have marked the foreign exchange market during the last week. On Tuesday, May 23, francs were 9.035c.; lire, 5.125c.; marks, 0.335c.; and Canadian dollars, 99.125c.

Silver

New high prices for the year were established on May 22 at 37⅞d. in London and 73⅜c. in New York. The latter figure was also ⅛c. higher than the top price in New York for 1921. During the last week the market has fluctuated violently, due to the abrupt changes of position of Chinese and Indian operators.

Mexican Dollars—May 18th, 56¼; 19th, 55; 20th, 56; 21st, 56⅜; 22d, 55⅝; 23d, 55.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—20c. per lb. for 99 per cent grade; 19c. for 98@99 per cent; 18c. for 94@98 per cent. Outside market nominal at 17.50@18.50c. for 98@99 per cent virgin grades.

Antimony — Chinese and Japanese brands, 5.40@5.50c. W.C.C., 6@6¼c. Cookson's "C" grade, spot, 8.75@9c. Chinese needle antimony, lump, nominal, 3.5@4c. per lb. Standard powdered needle antimony (200 mesh) nominal at 5¼c. per lb. White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, 6.75@7c.

Bismuth—$2@$2.10 per lb.

Cadmium—$1.15@$1.20 per lb.

Iridium—Nominal, $150@$170 per oz.

Nickel—Standard market, ingot and shot, 36c.; electrolytic, 39c. Small tonnages, spot, nominal at 30@33c.

Palladium—$55 per oz.

Platinum—$85 per oz.

Quicksilver—$55 per 75-lb. flask. San Francisco wires $54.70.

The prices of Cobalt, Molybdenum, Monel Metal, Osmium, Rhodium, Selenium, Thallium and Tungsten are unchanged from the prices in the issue of May 6.

Metallic Ores

Molybdenum Ore—50c. per lb. of MoS_2, for 85 per cent MoS_2 concentrates.

Tungsten Ore—Chinese, price advanced to $3.50@$3.75 per unit.

The prices of Bauxite, Chrome, Manganese, Tantalum, Uranium, Vanadium, Titanium and Iron Ore, Zircon and Zirkite are unchanged from the prices in the issue of May 6.

Zinc and Lead Ore Markets

Joplin, Mo., May 20—Zinc blende, per ton, high, $32.50; basis 60 per cent zinc, premium, $31; Prime Western, $29@$30; fines and slimes, $28@$27; average settling price, all grades of blende, $29.66. Calamine, 40 per cent zinc, average, $12.

Lead, high, $73.60; basis 80 per cent lead, $70; average settling price, all grades of lead, $70.44 per ton.

Shipments for the week: Blende, 10,661; calamine, 102; lead, 1,348 tons. Value, all ores the week, $413,680.

Reports have reached here that zinc smelters in Pennsylvania and West Virginia are closed owing to fuel shortage. No trouble is reported from the Illinois smelting region, and generally the gas situation will permit continued operations in Oklahoma. One Oklahoma smelter was closed last week by striking smeltermen. An advance of 5 per cent was accorded, and part of the works only was restarted. Buyers assumed that a lessened demand for ore would result from this situation and hoped to secure this week's tonnage on a $29 basis Prime Western, but many sellers declined to accept such offerings and purchases were 900 tons less than last week.

Platteville, Wis., May 20 — Blende, basis 60 per cent zinc, $31 per ton. Lead ore, basis 80 per cent lead, $72 per ton. Shipments for the week: Blende, 309; lead ore, 37 tons. Shipments for the year: Blende, 6,000; lead ore, 867 tons. Shipped during the week to separating plants, 750 tons blende.

Non-Metallic Minerals

Feldspar—One producer reports No. 1 pottery grade has recently been in good demand at a slight recession in price, $6.40 per ton, f.o.b. Eastern mines.

Talc—20 to 200 mesh, $7@$12 per ton, f.o.b. Vermont; $8@$10, f.o.b. Georgia; 200 mesh, $18, f.o.b. California; through No. 25 Swiss silk, $25, f.o.b. California. Market fair.

Prices are unchanged from those in the issue of May 6, on Asbestos, Barytes, Borax, Chalk, China Clay, Emery, Fluorspar, Fuller's Earth, Graphite, Gypsum, Limestone, Magnesite, Mica, Monazite, Phosphate, Pumice, Pyrites, Silica and Sulphur.

Mineral Products

Arsenic Oxide—7c. per lb.

Copper Sulphate—Nominally 6c. per lb. Extremely scarce.

Sodium Nitrate—$2.70@$2.80 per 100 lb. ex-vessel Atlantic ports.

Sodium Sulphate—$20@$25 per ton, New York.

The price of Potassium Sulphate is unchanged from that of May 6.

Ferro-Alloys

Ferromanganese—Domestic, 78 to 82 per cent, $67@$69, f.o.b. furnace; English, $67.50; German, $66, both c.i.f. Atlantic seaports. Spiegeleisen, 19 to 21 per cent, scarce at $35 per gross ton, f.o.b. furnace; 16 to 19 per cent, $34.

Ferrotungsten — Domestic, 70 to 80 per cent W, 45@50c. per lb. of contained W, f.o.b. works.

Ferrotitanium, Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrosilicon, Ferro-uranium, and Ferrovanadium are unchanged from the prices published May 6.

Metal Products

Copper Sheets — New York base, 20.25c. per lb.; wire, 15c.

Nickel Silver—26.75c. per lb. for 18 per cent nickel Grade "A" sheets.

Yellow Metal — Dimension sheets, 17.50c.; rods, 14.50c.

Lead Sheets and Zinc Sheets are unchanged from the prices published May 6.

Refractories

Bauxite Brick, Chrome Brick, Chrome Cement, Firebrick, Magnesite Brick, and Silica Brick are unchanged from the prices quoted May 6.

The Iron Trade

Pittsburgh, May 23, 1922.

In freight cars, automobiles, and fabricated structural work the steel market has been and continues unusually active. Otherwise it is quieter than in March or April.

Automobile production is probably at record rate, with fully 200,000 passenger cars to be turned out this month. Freight car buying has averaged 15,000 cars a month thus far this year. Since April 1 fabricated steel lettings have been fully equal to capacity, against 53 per cent for the first quarter and 35 per cent in 1921. These three lines of consumption, however, hardly account and for 25 per cent of current steel production, the rate of ingot production being somewhat over 37,000,000 tons a year against rates of about 35,000,000 tons on March 31 and 20,000,000 tons in December.

Steel prices are firm, with bars, shapes, and plates rarely going at under 1.60c., and occasional small sales at higher prices. Hoops are now quoted at 2.25c., or $5 a ton advance. In nearly all lines, however, mill shipments are largely against sales made at close to the bottom.

Pig Iron—The market is stagnant, prices being largely nominal at $26 for bessemer, $25 for basic, and $24 for foundry, f.o.b. Valley furnaces.

Coke

Connellsville Coke — Production is now increasing slightly, but the strike is still exercising a retarding influence. Furnace coke, $6.25@$6.50; foundry, $6.75, with turnover limited.

COMPANY REPORTS

Miami Copper Co.

A report of the operations of the Miami Copper Co. for 1921 shows a net profit of $929,984.35 before depletion. Dividends of $1,494,228 were paid. Operating account follows:

	Per Pound	
To concentrates		
53,243,945 lb. @	$0.0650220	$3,462,032.43
General mine expenses	0.0134722	717,316.63
Freight on concentrates	0.0071653	381,504.94
Smelting, refining and freight on pig copper	0.0174878	931,124.42
Legal expense	0.0030396	161,833.01
New York office expense and taxes	0.0045878	244,274.57
Selling expenses, freight, discount, and commissions	0.0029529	157,223.12
	$0.1137276	$6,055,309.12
Less silver proceeds, rentals, and sales of power and water	0.0008831	47,021.67
	$0.1128445	$6,008,287.45
Balance carried down		750,352.57
		$6,758,640.02
Deliveries of copper during year		
51,283,681 lb. @	$0.129909	$6,662,211.87
Less on hand Jan. 1, 1921		
16,267,740 lb. @	0.123478	2,008,722.03
35,015,941		$4,653,489.84
Plus on hand Dec. 31, 1921		
Refined copper sold		
2,037,186 lb. @	$0.13651	$278,105.42
In process		
16,190,818 lb. @	0.1128445	1,827,044.76
53,243,945 lb.		$2,105,150.18
		$6,758,640.02

PROFIT-AND-LOSS ACCOUNT

Depreciation charged off during year	$336,267.29
Balance carried to balance sheet	929,984.35
	$1,266,251.64
Balance brought down	$750,352.57
Interest	200,764.73
Difference in value of securities on Dec. 31, 1921	315,134.34
	$1,266,251.64

Balance sheet as of Dec. 31, 1921, is given as follows:

ASSETS

Property		
Mines and mining claims	$26,196,728.52	
Ranches and other lands	270,869.06	
		$26,467,597.58
Development		
Mine development	$923,493.16	
Shaft No. 5 development	274,678.46	
		1,198,171.62
Construction and equipment		3,564,838.06
Ore and metals on hand		2,135,059.66
Sundry materials and supplies		826,809.00
Prepaid taxes and insurance		18,569.81
Cash		261,969.84
Accounts receivable		212,881.87
Sundry investments and securities		4,282,061.42
		$38,967,958.86

LIABILITIES

Capital stock		
Authorized 800,000 shares @ $5		$4,000,000.00
Issued 747,114 shares @ $5		3,735,570.00
Accounts payable		1,425,908.68
Reserve for depletion		14,228,977.89
Surplus account		
Paid-in surplus, balance Jan. 1, 1921	$22,047,562.99	
Dividends No. 34 to 37	1,494,228.00	
	$20,553,334.99	
Earned surplus balance Jan. 1, 1921	*$186,528.24*	
Depletion for year 1921	*1,719,288.81*	
	$1,905,817.05	
Transferred from profit and loss account	929,984.35	
	$975,832.70	$19,577,502.29
		$38,967,958.86

Italics indicate deficit.

Ore reserves on Jan. 1, 1922, are estimated at 8,900,000 tons of 2.26 per cent copper ore; 6,000,000 tons of 2 per cent copper ore; and 36,000,000 tons of 1.06 per cent copper ore.

Yukon Gold Co.

A report of the operations of the Yukon Gold Co. for 1921 shows a net deficit of $346,875.13, according to the following income statement:

	Production	Working Costs	Operating Gain
Dawson dredge	$222,813.15	$174,042.88	$48,770.27
Dawson hydraulics	269,632.90	172,504.45	97,128.45
California dredges	311,787.05	278,997.24	32,789.81
Murray dredge	149,821.02	90,686.16	59,134.86
Miscellaneous operations	16,868.92	556.01	16,312.91
Total operations	$970,923.04	$716,786.74	$254,136.30
Non-operating income			70,768.83
Total income			$324,905.13
Less			
Royalties paid		$35,192.79	
Interest, general expense, examinations		271,664.72	
Depletion		158,770.47	
Depreciation		206,152.28	
			671,780.26
Net deficit for 1921			$346,875.13

Balance sheets as of Dec. 31, 1921, and Dec. 31, 1920, follow:

ASSETS

	Dec. 31, 1921	Dec. 31, 1920
Properties and investments at cost	$15,619,246.65	$15,350,885.24
Less deductions for depletion and revaluation	13,299,232.25	13,140,461.78
Properties and investments as revalued	$2,320,014.40	$2,210,423.46
Equipment	$9,394,615.56	$8,912,455.82
Less deductions for depreciation	6,960,308.41	6,754,156.13
Equipment as revalued	$2,434,307.15	$2,158,299.69
Deferred charges	$169,537.10	$193,921.20
Advance royalties	10,000.00	10,000.00
Materials and supplies	451,445.28	465,804.23
Notes receivable—subsidiary companies	2,032,441.94	1,924,290.31
Accounts collectible	137,846.03	350,636.36
U. S. and Canadian government bonds	707,674.00	249,000.00
Bullion in transit	15,710.77	20,046.73
Cash	72,801.24	250,570.65
	$8,351,777.91	$7,832,992.63

LIABILITIES

Yukon-Alaska Trust notes	$5,462,695.71	$4,375,000.00
Yukon-Alaska Trust advances		200,000.00
Bills and accounts payable	294,790.59	160,137.04
Letters of credit pending payment—not due	148,036.68	298,585.13
Reserve for replacements	39,461.79	45,602.19
	$5,944,984.77	$5,079,324.36
Capital stock—par value issued for cash or properties	$17,500,000.00	$17,500,000.00
Net amount realized from operations	15,024,443.80	15,006,396.18
	$32,524,443.80	$32,506,396.18
Distributed to stockholders	$9,858,110.00	$9,858,110.00
Deductions due to depletion	5,342,226.84	5,183,456.37
Deductions due to revaluation	7,957,005.41	7,957,005.41
Deductions due to depreciation	6,960,308.41	6,754,156.13
	$30,117,650.66	$29,752,727.91
Balance representing excess of assets over liabilities, including properties owned at March 1st, 1913, on the basis of their fair value and including properties subsequently acquired at their cost	$2,406,793.14	$2,753,668.27
	$8,351,777.91	$7,832,992.63

Operations are summarized as follows:

	Production	Average Yield per Unit Value	Cost Per Unit
Dawson dredging, cu.yd.	556,957	40.01c.	31.25c.(a)
California dredging, cu.yd.	3,988,340	7.817c.	6.995c.(a)
Idaho dredging, cu.yd.	1,540,446	9.726c.	5.887c.(a)
Dawson hydraulics, cu.yd.	1,069,468	25.21c.	16.13(a)
Nevada lode, tons	38,129	$14.91	$6.64(a)
Mayo silver-lead, tons	2,110(b)	$179.16	$13.03
Malay tin, cu.yd.	185,600(c)	.....	.....

(a) Exclusive of depreciation.

(b) Assay value, 195.8 oz. silver and 62.2 per cent lead, giving net profit of $104.246.

(c) Producing 44,964 lb. of concentrates, or 32,192 lb. of tin.

Tonopah Belmont Development Co.

A report of the operations of the Tonopah Belmont Development Co. for 1921 shows a net profit of $388,780.40 (dividend payments totaled $150,000), according to the following comparative account:

	Year Ended Dec. 31, 1921	Year Ended Dec. 31, 1920
Gross value of production	$1,793,660.17	$1,796,141.51
Losses in treatment	147,701.62	141,338.28
Net values realized	$1,645,958.55	$1,654,803.23
Operating expenses	1,153,964.49	1,252,395.55
Net earnings mine and Tonopah mill	$491,994.06	$402,407.68
Net earnings of other plants	23,856.99	55,418.81
Total net earnings	$515,851.05	$457,826.49
Other income	(a) 56,149.58	(a) 204,531.74
Gross income	$572,000.63	$662,358.23
Administration, exploration and taxes	(b) 183,220.23	59,211.51
Net profit	$388,780.40	$603,146.72

(a) Includes dividends from Belmont Surf Inlet Mines, Ltd.

(b) Includes $130,750.29 expenses and losses occasioned by labor strike.

Balance sheet as of Dec. 31, 1921, follows:

ASSETS		
Property		
Mines and mining claims (revalued as of March 1, 1913, at $5,000,000) after writing off $3,192,804.22 depletion	$1,807,195.78	
Shafts, buildings and machinery, after writing off $414,006.12 depreciation	43,192.96	
Millers mill, after writing off $491,090.09 depreciation	65,051.22	
Tonopah mill, after writing off $428,566.76 depreciation	91,942.97	
Re-treatment plant for sweepings, after writing off $4,660.75 depreciation	10,000.00	
		$2,017,382.93
Investments		
Belmont Surf Inlet Mines, Ltd.	$1,292,352.94	
Belmont Shawmut Mining Co.	792,450.83	
Belmont Wagner Mining Co.	853,575.13	
Esmeralda Power Co.	6,206.25	
Tonopah Divide Mercantile Co.	10,650.00	
Tonopah Mines Hospital Association	1,325.00	
		2,956,560.15
Secured loan to Jim Butler Tonopah Mining Co.		40,763.14
Available assets		
Materials and supplies for operation	$157,171.80	
Ore stock on hand	48,354.24	
Insurance premiums paid in advance	5,603.32	
Accounts receivable	261,458.34	
U. S. Government certificates of indebtedness	100,000.00	
Cash in bank	207,895.55	
		780,483.25
		$5,795,189.47
LIABILITIES		
Capital stock		
1,500,000 shares of $1 each fully issued		$1,500,000.00
Current liabilities		126,583.61
Property reserve account arising in respect of the revaluation of mines and mining claims as of March 1, 1913		2,989,040.84
Surplus		
Balance of undivided profits up to Dec. 31, 1920 (last report)	$1,284,884.22	
Net income for year ended Dec. 31, 1921	388,780.40	
	$1,673,664.62	
Deduct		
Charge for depletion of ore, 1921. $344,099.60		
Dividends paid to shareholders. 150,000.00		
	494,099.60	
		1,179,565.02
		$5,795,189.47

Production of the Belmont mill amounted to 18,073 oz. of gold and 1,747,950 oz. of silver. A total of 138,031 tons was milled at a cost of $3.317 per ton. Mining costs were $5.296 per ton.

Winona Copper Co.

The report of the directors of the Winona Copper Co., with head office at Boston and mining properties at Winona, Mich., states that no mining operations have been carried on since May, 1920. Expenses of the Boston office during the year were $5,229.96, and net expenses at Winona, after sale of supplies and income from rentals, $1,124.42. The company is carrying 130,546 lb. of copper on inventory, and has $7,221.88 in cash.

The president states that he believes the cross valleys of the Sleeping River and its branches mark a mineralized shear-zone south of No. 2 King Philip shaft, and that the property should not be condemned until further exploration has been made.

Mexican Silver To Supply the Orient?

The Mexican consul in Hongkong, China, writes his government at Mexico City:

"The large banking houses in the Far East are taking an active interest in the recent declaration of the Mexican Monetary Commission that it is now in a position to make extensive and regular shipments of silver bars to China.

"The Bank of Canton states that it has already been receiving certain quantities of Mexican silver bullion through its San Francisco correspondents and considers the quality equal to American exports.

"Bigger, manager of the Asia Banking Corporation, has expressed a desire to get in touch with the Mexican Monetary Commission, and states that his institution could use 500,000 oz. monthly. The Banque De L'Indo-China also desires 200,000 oz. monthly and requests that shipments begin the first of July."

The consul adds that the Americans at present control the silver market, but suggests to his government an excellent opportunity to put Mexican silver not only in Canton, Shanghai, Pekin and other Chinese ports, but believes they can invade Salgon, Singapore, and Colombo.

In view of these representations, the Mexican government has under consideration a plan for subsidizing one or more Chinese steamship lines in order to get direct communication from west coast Mexican ports to Asiatic ports.

United States Lead Production

The following is a comparative table of domestic lead production prepared by C. E. Siebenthal and A. Stoll, of the U. S. Geological Survey:

	1919 Short Tons	1920 Short Tons	1921 Short Tons
Domestic desilverized lead	208,751	220,327	187,962
Domestic soft lead	147,744	189,854	157,513
Domestic desilverized soft lead	67,938	66,668	52,747
	424,433	476,849	398,222
Foreign desilverized lead	57,787	52,808	50,367
Total refined primary lead	482,220	529,657	448,589
Antimonial lead	13,874	12,535	10,064

APPARENT CONSUMPTION OF REFINED PRIMARY LEAD IN THE UNITED STATES

(Refinery Stocks Disregarded)

Supply			
Stock in bonded warehouse Jan. 1	472	234	1,322
Imports of pigs, bars, and old	5,107	35,719	31,301
Production	482,220	529,657	448,589
	487,799	565,610	481,212
Withdrawals			
Exports of foreign lead—			
From warehouse	40,976	17,363	25,000
In manufactures, with benefit of drawback	1,936	6,175	9,369
Exports of domestic lead	10,510	2,730	1,624
Stock in bonded warehouse Dec. 31	234	1,322	347
	53,656	27,590	36,340
Apparent consumption	434,143	538,020	444,872
Lead content of ore and bullion in bonded warehouse Dec. 31 (a)	45,476	51,220	98,186
Average selling price in cents per pound	5.3	8.0	4.5

(a) Some part of this may have been smelted and refined and thus be included in the quantities given above as "Foreign desilverized lead."

Mining Dividends for May, 1922

The following dividends were paid by mining and metallurgical companies during May, 1922:

Companies in the United States:	Situation	Per Share	Total
Chief Consolidated, s,l	Utah	$0.05Q	$44,201
Colorado Fuel & Iron pfd	Col., N. M., Wyo.	2.00Q	40,000
General Development Co.	Various states	0.25	30,000
Homestake Mining, g	S. D.	0.25M	62,790
International Nickel pfd	N. J., Ont.	1.50Q	133,689
Miami Copper	Arizona	0.50Q	373,557
New Cornelia Copper	Arizona	0.25Q	450,000
New Jersey Zinc	New Jersey	2.00Q	909,328
United Verde Extension, c	Arizona	0.25Q	262,500
Companies in other countries:			
Amparo Mining, g,s	Mexico	0.03Q	60,000
Cie. Aramayo de Mines en Bolivie, t, s, c	Bolivia	1.25fr.	750,000fr.
Hollinger Gold	Ontario	$0.05 4 wks.	$246,000
McIntyre Porcupine Gold	Ontario	0.05	182,014

Q, quarterly; M, monthly; g, gold; s, silver; c, copper; l, lead; t, tin.

The General Development Co. paid its first dividend since August, 1920.

MINING STOCKS

Week Ended May 20, 1922

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Ahmeek	Boston	65	60½	65	Sept. 20, Q	$0.50
Alaska-Br. Col. new.	N. Y. Curb	5¼	4¼	4¼		
Allouez	Boston	29	26½	28½	Mar. '19	1.00
Anaconda	New York	55½	52½	55½	Nov. '20, Q	1.00
Arcadian Consol.	Boston	4½	3¼	4¼		
Ariz. Com'l	Boston	10	9½	10	Oct. '18, Q	0.50
Big Ledge	N. Y. Curb	*28	*18	*21		
Bingham Mines	Boston	15¾	15	15¾	Sept. '19, Q	0.25
Calumet & Arizona	Boston	63¼	59	62½	Mar. '22, Q	0.50
Calumet & Hecla	Boston	286	265	285	June '20, Q	5.00
Canada Copper	N. Y. Curb	*50	*41	*49		
Centennial	Boston	10½	10½	10½	Dec. '18, SA	1.00
Cerro de Pasco	New York	39⅜	37¼	39⅜	Mar. '21, Q	0.50
Chile Copper	New York	23	19⅜	22⅛		
Chino	New York	32⅛	28	31⅛	Sept. '20, Q	0.37½
Columbus Rexall	Salt Lake	*28	*27	*27		
Con. Arizona	N. Y. Curb	*5	*3	*5	Dec. '18, Q	0.05
Con. Copper Mines	N. Y. Curb	2	1½	1⅝		
Copper Range	Boston	44⅜	41½	44½	Mar. '22, Q	1.00
Crystal Copper	Boston Curb	1 1/16	1 1/16	1⅛		
Davis-Daly	Boston	9	8½	8½	Mar. '20, Q	0.25
East Butte	Boston	11⅜	10	11½	Dec. '19, A	0.50
First National	Boston Curb	*90	*67	*70	Feb. '19, SA	0.15
Franklin	Boston	2⅜	2⅜	2½		
Gadsden Copper	Boston Curb	1¼	1¼	1¼		
Granby Consol.	New York	32½	28	32½	May '19, Q	1.25
Greene-Cananea	New York	34	31½	33½	Nov. '20, Q	0.50
Hancock	Boston	3⅜	3	3⅜		
Howe Sound	N. Y. Curb	3⅜	3¼	3¼	Jan. '21, Q	0.05
Inspiration Consol.	New York	43	40¼	42½	Oct. '20, Q	1.00
Iron Cap	Boston Curb	8½	7	8½	Sept. '20, K	0.25
Isle Royale	Boston	26	23½	25⅜	Sept. '19, SA	0.50
Kennecott	New York	39½	33¼	38½	Dec. '20, Q	0.50
Keweenaw	Boston	3	2⅜	3		
Lake Copper	Boston	5	4½	5		
La Salle	Boston	1 1/16	1	1⅛		
Magma Copper	N. Y. Curb	1⅜	*75	1¼	Jan. '19, Q	0.50
Majestic	Boston Curb	*10	*10	*10		
Mason Valley	Boston	2⅜	2	2¼		
Mass. Consolidated	Boston	4¼	3½	3½	Nov. '17, Q	1.00
Miami Copper	New York	31	28⅞	30¾	May '22 Q	0.50
Michigan	Boston	3	2½	2½		
Mohawk	Boston	63	56½	63	Feb. '22, Q	1.00
Mother Lode Coa.	N. Y. Curb	10⅞	9⅜	10⅜		
Nevada Consol.	New York	18⅜	16⅛	18⅜	Sept. '20, Q	0.25
New Cornelia	Boston	19⅞	17⅜	19⅞	Feb. '22, K	0.25
North Butte	Boston	13¼	12¼	13½	Oct. '18, Q	0.25
North Lake	Boston			*40		
Ohio Copper	N. Y. Curb	*10	*9	*10		
Old Dominion	Boston	26½	23	26½	Dec. '18, Q	1.00
Osceola	Boston	37½	35	36½	June '20, Q	0.50
Phelps Dodge	Open Mar.	†180	†170	...	Apr. '22, Q	1.00
Quincy	Boston	47½	44	47½	Mar. '20, Q	1.00
Ray Consolidated	New York	18½	16½	18	Dec. '20, Q	0.25
Ray Hercules	N. Y. Curb	1¼	1⅛	1⅛		
St. Mary's Min. Ld.	Boston	48	45	46½	Apr. '22, K	2.00
Seneca Copper	Boston	14½	13⅜	14½		
Shannon	Boston	1½	*95	1⅜	Nov. '17, Q	0.25
Shattuck Arizona	New York	11½	8⅞	10⅜	Jan. '20, Q	0.25
South Lake	Boston	1¼	1¼	1¼		
Superior & Boston	Boston	1⅜	1⅜	1⅜		
Tenn. C. & C. cfs	New York	12¾	11⅛	12⅜	May '18, I	1.00
Tuolumne	Boston	*90	*69	*90	May '13,	0.10
United Verde Ex.	Boston Curb	31	28	31	May '22, Q	0.25
Utah Consol.	Boston	3	2⅜	3	Sept. '18,	0.25
Utah Copper	New York	68½	64¼	67⅝	Mar. '22, Q	0.50
Utah Metal & T.	Boston	1½	1¼	1½	Dec. '17,	0.30
Victoria	Boston	2	1⅞	2		
Winona	Boston	2	1⅞	1⅞		
Wolverine	Boston	15	13	15		
NICKEL-COPPER						
Internat. Nickel	New York	18⅜	17⅜	18	Mar. '19,	0.50
Internat. Nickel, pfd	New York	82¼	82½	82½	Feb. '22, Q	1.50
LEAD						
National Lead	New York	96½	92	94⅜	Mar. '22, Q	1.50
National Lead, pfd	New York	110	109⅜	110	Mar. '22, Q	1.75
St. Joseph Lead	New York	15⅜	15⅛	15⅛	Mar. '22, Q	0.25
QUICKSILVER						
New Idria	Boston	2	1½	1½		
ZINC						
Am. Z. L. & S.	New York	20⅛	18	20	May '20,	1.00
Am. Z. L. & S. pfd.	New York	48½	44½	48½	Nov. '20, Q	1.50
Butte C. & Z.	New York	8⅛	6⅞	7⅞	June '18,	0.50
Butte & Superior	New York	33⅛	30¼	33⅛	Sept. '20,	1.25
Callahan Zn-Ld.	New York	9⅞	8	9⅛	Dec. '20, Q	0.50
New Jersey Zn.	N. Y. Curb	145½	144	144	May '22, Q	2.00
Yellow Pine	Los Angeles	*52	*50	*51½	Sept. '20, Q	0.03

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Hamilton B. Wills; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Commerce and Oil; Colorado Springs, The Financial Press, N. Y.

Stock	Exch.	High	Low	Last		Last Div.
GOLD						
Alaska Gold	New York	⅛	⅛	⅛		
Alaska Juneau	New York	2	1	1⅛		
Carson Hill	New York	†4⅞	†4⅝	†4⅝		
Cresson Consol. G.	N. Y. Curb	2¼	2 1/16	2⅛	Apr. '22, Q, X	$0.10
Dome Extension	Toronto	1	1	1		
Dome Mines	New York	28½	27½	28½	Apr. '22, Q	1.00
Florence Goldfield	N. Y. Curb	*23	*18	*23		
Golden Cycle	Colo. Springs	*77	*77	*77	June '21, Q	0.02
Goldfield Consol.	N. Y. Curb	*7	*7	*7	Dec. '19,	0.05
Hollinger Consol.	Toronto	9.70	9.55	9.60	May '22,	0.05
Homestake Mining	New York	72	70	72	Apr '22, M	0.25
Kirkland Lake	Toronto	*45½	*45	*45		
Lake Shore	Toronto	2.39	2.25	2.35	Nov. '21, K	0.02
McIntyre-Porcupine	Toronto	19.25	17.70	18.00	May '22, K	0.05
Porcupine Crown	Toronto	*28½	*26	*28½	July '17,	0.03
Porcupine V. N. T.	Toronto	*37	*32	*32		
Portland	Colo. Springs	*27	*25	*27	Oct. '20, Q	0.01
Schumacher	Toronto	*57½	*55	*56		
Silver Pick	N. Y. Curb	*17	*13	*16		
Teck Hughes	Toronto	*54	*52	*53		
Tom Reed	Los Angeles	*75	*73	*74	Dec. '19,	0.02
United Eastern	N. Y. Curb	1 1/16	1	1⅛	Apr. '22, Q	0.15
Vindicator Consol.	Colo. Springs	*10	*8	*10	Jan. '20, Q	0.01
White Caps Mining	N. Y. Curb	*8	*4	*8		
Wright-Hargreaves	Toronto	3.00	2.70	3.00	Apr. '22,	0.02½
Yukon Gold	N. Y. Curb	1⅛	*90	1	June '18,	0.02½
SILVER						
Batopilas Mining	New York	1⅛	1	1	Dec. '07, I	0.12½
Beaver Consol.	Toronto	*34½	*30	*32	May '20, K	0.03
Coniagas	Toronto	1.25	1.20	1.25	May '21, Q	0.12½
Crown Reserve	Toronto	*19	*16½	*18	Jan. '17,	0.05
Kerr Lake	N. Y. Curb	3⅜	3⅛	3⅛	Apr. '22, Q	0.12½
La Rose	Toronto	*37	*31	*35½	Apr. '22,	0.10
McKinley-Dar.-Sav.	Toronto	*29½	*28	*28½	Oct. '20, Q	0.03
Mining Corp. Can.	Toronto	1.15	1.00	1.05	Sept. '20, Q	0.12½
Nipissing	N. Y. Curb	6⅜	6	6½	Apr. '22, Q, X	0.30
Ontario Silver	New York	8⅛	7⅜	8½	Jan. '19, Q	0.50
Ophir Silver	N. Y. Curb			*12	Jan. '12,	0.10
Temiskaming	Toronto	*35	*30	*30½	Jan. '20, K	0.04
Trethewey	Toronto	*5	*4	*4½	Jan. '19,	0.05
GOLD AND SILVER						
Boston & Montana	N. Y. Curb	*26	*20	*22		
Cash Boy	N. Y. Curb	*5	*5	*5		
Dolores Esperanza	N. Y. Curb	2⅜	2⅛	2⅛		
El Salvador	N. Y. Curb	*6	*6	*6		
Jim Butler	N. Y. Curb	....	....	*8	Aug. '18, SA	0.07
Jumbo Extension	N. Y. Curb	....	....	*5	June '16,	0.05
MacNamara M.&M.	N. Y. Curb	*9	*9	*9	May '10,	0.02½
Tonopah Belmont	N. Y. Curb	1 1/16	1⅛	1 1/16	Apr. '22, Q	0.05
Tonopah Divide	N. Y. Curb	*76	*74	*76		
Tonopah Extension	N. Y. Curb	1 1/16	1⅛	1 1/16	Apr. '22, Q	0.05
Tonopah Mining	N. Y. Curb	1⅛	1⅛	1 1/16	Apr. '22, SA, X	0.07½
West End Consol.	N. Y. Curb	1	*97	1	Dec. '19, SA	0.05
SILVER-LEAD						
Caledonia	N. Y. Curb	*7	*6	*7	Jan. '21, M	0.01
Cardiff M. & M.	Salt Lake	*95	*93	*95	Dec. '20,	0.15
Chief Consol.	Boston Curb	5	4½	4¾	May '22, Q	0.05
Consol. M. & S.	Montreal	23	22½	23	Oct. '20, Q	0.62½
Daly Mining	Salt Lake	†3.00	†1.40	...	July '20, Q	0.10
Daly-West	Boston	†2½	†2	2	Dec. '20, Q	0.25
Eagle & Blue Bell	Boston Curb	†3	†2½	2½	Apr. '21, K	0.05
Electric Point	Spokane	*6	*6	*6	May '20, SA	0.03
Federal M. & S.	New York	16½	13⅜	15	Jan. '09,	1.50
Federal M. & S. pfd.	New York	53⅜	44	52½	Mar. '22, Q	1.00
Florence Silver	Spokane	*22½	*22	*22	Apr. '19,	0.01½
Grand Central	Salt Lake	†*63	†*60	*75	Jan. '21, K	0.01
Hecla Mining	N. Y. Curb	6⅜	6⅛	6⅜	Mar. '22, Q	0.15
Iron Blossom Con.	N. Y. Curb	*23	*23	*23	Apr. '22, Q	0.02½
Judge M. & S.	Salt Lake	†2.50	†2.30	2.60	Sept. '20, Q	0.12½
Marsh Mines	N. Y. Curb	*21	*19	*21	June '21, I	0.02
Prince Consol.	Salt Lake	*7	*3½	*7	Nov. '17,	0.02½
Rambler-Cariboo	Spokane	*6½	*5	*5	Feb. '19,	0.01
Rex Consol.	N. Y. Curb	*11	*8	*10		
South Hecla	Salt Lake	†*60	†*35	...	Sept. '19, K	0.15
Standard Silver-Ld.	N. Y. Curb	*22	*20	*21	Oct. '17,	0.05
Stewart Mines	N. Y. Curb	*11	*9	*10	Dec. '15,	0.05
Tamarack-Custer	Spokane	2.45	2.45	2.45	Jan. '21, K	0.04
Tintic Standard	Salt Lake	2.20	2.00	2.02½	Dec. '21, Q	0.05
Utah Apex	Boston	3½	3	3⅛	Nov. '20, K	0.25
Wilbert Mining	N. Y. Curb	....	....	*2	Nov. '17,	0.01
VANADIUM						
Vanadium Corp.	New York	52⅜	47½	50⅞	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	56	56	56	Apr. '22, Q	1.50
Asbestos Corp. pfd.	Montreal	75½	75	75½	Apr. '22, Q	1.75
SULPHUR						
Freeport, Texas	New York	22⅛	19½	21⅛	Nov. '19, Q	1.00
Texas Gulf	New York	48⅜	43	46⅜	Mar. '22, QX	1.00
MINING, SMELTING AND REFINING						
Amer. Sm. & Ref.	New York	67⅜	58	65⅜	Mar. '21, Q	1.00
Amer. Sm.& Ref. pf.	New York	98½	96¼	98½	Mar. '22 Q	1.75
Am. Sm. Sec. pf. A.	New York	92⅜	92½	92⅜	Apr. '22, Q	1.50
U. S. Sm. R. & M.	New York	45½	41	44½	Jan. '21, Q	0.50
U.S. Sm.R.& M. pf.	New York	46¼	45½	46½	Apr. '22, Q	1.75

NEW MACHINERY AND INVENTIONS

The Use of Deflecting Wedges in Diamond-Drill Holes

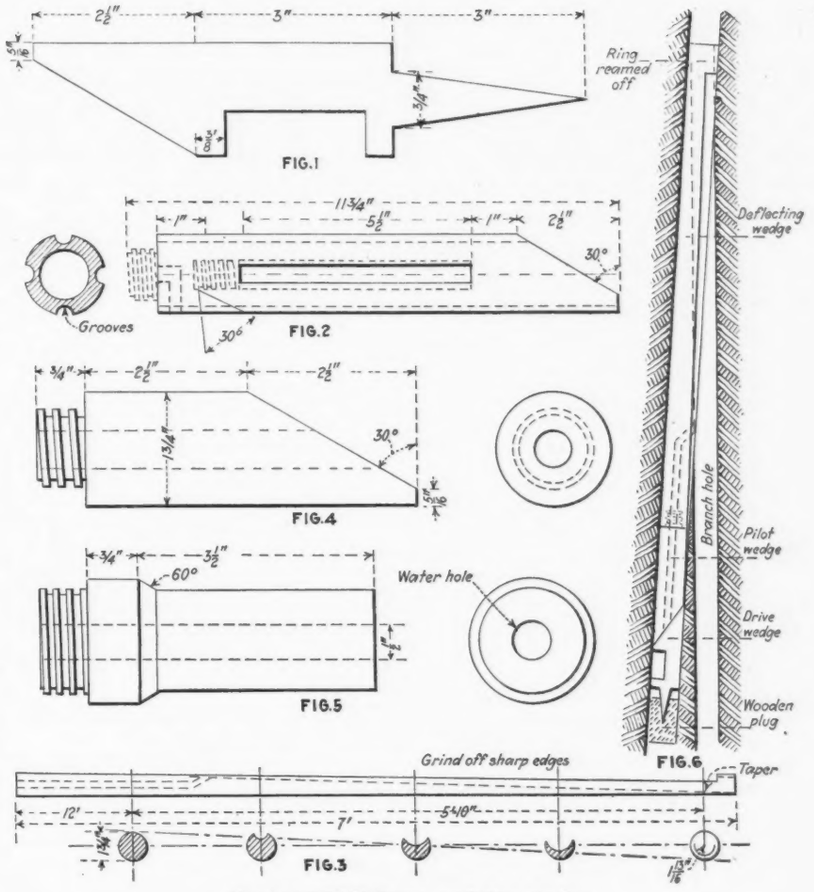
Method That Makes Possible The Drilling of Vertical Bores and That Overcomes Many Disadvantages of Ordinary Diamond Drilling

ONE of the main limitations of diamond-drill work has been the inability to drill a straight hole. To depths of 1,000 ft. the deflection is often not large, but over this depth the hole tends to take a somewhat erratic course. As a means of overcoming this difficulty there has been developed the "Hall-Rowe" wedging method and device for controlling the direction of drill holes, which are the result of a long series of experiments. After the invention and perfection of this wedging method and device, holes were successfully bored to 3,000 ft. with practically no deflection. The method has become standard for all deep drilling and in all short holes where the formation deviates the rods.

In addition to controlling a hole and furnishing definite information there is supplied a simple and accurate method of making any number of branches to a hole and of securing a series of samples of ore discovered.

To wedge a diamond-drill hole at any point a dry, turned wooden plug, grooved to allow water to pass, is pushed down with the rods to the point where it is desired to branch the hole, and allowed to swell. A drive wedge, Fig. 1, is then dropped into the hole and driven into the wooden plug, using a blank bit for driving. The drive wedge, being cut out below the face, usually falls with the face of the wedge in the direction of dip, but in every case its position is surveyed carefully by using the special clinometer, Fig. 2.

Lines are cut on the inside of the clinometer parallel to and in the plane of the long axis of the 30 deg. beveled part of the clinometer. Lines indicating this plane are marked on the sides of a glass test tube with a small carbon, the low point of the bevel face being indicated. The glass tube is filled to a height of about two inches with hydrofluoric acid diluted with two parts water; a cork is put in, gummed paper placed over the cork and fastened to the sides of the tube, and the plane marked across the paper so that it fits the clinometer snugly. When lowered into the clinometer the marks coincide. The clinometer is lowered into the hole and allowed to set thirty minutes to take the etching. It is then pulled up, the tube cleaned and dried and the low and high point of the etching marked when the tube is held vertical. The relative direction of the face of the drive wedge and the dip of the hole are indicated. If the two low points coincide they are the same, and it is only necessary to set the face of the deflecting wedge (Fig. 4) in the same direction and lower them.



Parts of Hall-Rowe wedging device
Fig. 6 shows wedge placed in drill hole

If the two low marks do not coincide, it is necessary to determine the angle between them and to rotate the pilot wedge (Fig. 4) with regard to the deflection wedge, to bring the deflection wedge, when in place, in a direct opposite to the dip of the hole. Strips of paper wound around the test tube and wedge allow marking and measuring the arc determining the angle. If the dip is small, a standard dip protractor or the transit and protractor may be necessary to determine the low point of the etching.

A ring is left at the top of the deflecting wedge to lower it. The pilot wedge and deflecting wedge, properly orientated, are lowered by riveting a special plug threaded into a blank "A" bit to the ring with a copper rivet. Neither the 30-deg. face of the drive wedge nor the face of the pilot wedge is brought to a thin point, but an end ¼ in. thick is left. This provides a surface for driving the drive wedge; also, in one position the point of the pilot wedge will rest on the point of the drive wedge, and on being rotated 180 deg. the pilot wedge will drop 2 in. into its place, indicating when the two are in their proper relation. Shearing of the copper rivet gives a further drop of 3 in. The amount of stretch in the rods must also be taken into account in working at depth; 1,500 ft. of "A" rods have about 2.5 in. of slack.

When the deflecting wedge is in place an "E" bit and core barrel are used and an "E" hole is drilled to a point 3 or 4 ft. below the wedge. The curved face of the deflecting wedge is "E" size, so the "E" bit follows the wedge without cutting into it. After the "E" drilling, the wedge and deflected hole are reamed out with the special reaming bit, Fig. 5.

The small part of this is "E" size and acts as a pivot. Diamonds are set in the beveled part to ream the wedge and hole out to "A" size. After doing this the regular "A" rods and "A" bit are used, but reaming with the "A" bit is started at the top of wedge to make sure there is ample clearance for passing up and down. The "A" hole is continued as an "A" hole below the wedge.

The average correction per wedge is 2 deg., and thus a hole should be wedged before it deflects much more than this. Experience has shown that it requires about five shifts to place a wedge properly.

The following are some of the economic uses of the Hall-Rowe wedge:

(a) A bore hole started vertically is prevented from deflecting more than 2 deg. and therefore accuracy is assured; also, a given ore zone will not

be missed. (b) A second core from an orebody can be obtained without redrilling the entire hole. (c) Mining men have structure accurately determined, so that shafts, drifts, and crosscuts can be laid out to cost the minimum amount. (d) A hole lost due to some obstruction in the bottom could be continued with little loss of footage.

The exclusive rights to the Hall-Rowe wedging method are controlled by the Smith & Travers Co., Ltd., Sudbury, Ont.

Collar of Thermit Weld Permits Groove Inspection

The one fact that has been more responsible than any other for retarding the progress of welding, according to a statement by the Metal & Thermit Corporation, New York, is that when a weld is made it is impossible to determine without destroying it what strength is definitely assured and safe to allow. An examination of the surface of welds does not reveal this.

A Thermit weld, however, by reason of its collar, is the only method which allows a careful inspection and permits the drawing of proper conclusions as to the strength of welds. In Thermit welding it is impossible to have such defects as lack of fusion (if the proper amount of Thermit has been used and instructions have been carefully followed), or oxide inclusions, such as those formed during the adding of metal in other methods. Unclean surfaces, oxide inclusions (due, for example, to failure properly to clean scale from wrought-iron sections before welding) have always resulted in Thermit welding in only one type of defect—i. e., blow holes. This defect, due to the natural tendency of the gases to rise in the molten mass, if present at all, will always be present in the Thermit steel collars, and an examination internally of the collar can be made without affecting the strength of the weld.

In practice, this examination is made by gouging deep grooves in the Thermit steel collars parallel with the axis of the piece, these grooves reaching almost to the original section itself. Two such grooves on the four sides of a Thermit weld have been found to be sufficient. If these grooves are observed to be free and clean from blow-hole defects, the inspector may be absolutely assured that the weld itself is sound.

Motor Operated Gate Valves

The necessity of a reliable, efficient and expeditious method of valve control for steam lines, particularly in event of rupture of the main lines, is evident from a safety standpoint, the old method of direct manual operation being not only a slow procedure but frequently one of great danger.

Until the tests conducted by the Public Service Electric Co. at Newark, N. J., on Jan. 28, 1922, under the auspices of the National Electric Light Association, considerable doubt existed as to the possibility of closing a gate valve under the extreme velocity conditions occasioned by a ruptured steam line, but the test proved beyond question that a valve properly constructed would operate effectively.

The valve made by the Lukenheimer Co. of Cincinnati, Ohio, and used on the above test was a 10-in. cast steel, monel mounted, "Victor" gate, equipped with a Dean electric control. It successfully closed in less than thirty seconds against a boiler steam pressure of 225 lb. superheated 150 deg. F. The discharge end of the valve was open to the atmosphere, and the steam was permitted to escape for one minute and a half before the valve was closed.

Afterwards the seat and disk rings were carefully examined to ascertain the effect of this severe test and it was found that they were in perfect condition, and showed no marks, such as would be occasioned by the disk dragging across the seats in valves wherein the disk is not properly guided.

These motor-operated gate valves are procurable in either iron body bronze mounted or cast steel monel mounted patterns in sizes 6 in. and larger.

TRADE CATALOGS

Pumps.—We are in receipt of a folder containing several data sheets issued by the Aldrich Pump Co., of Allentown, Pa. This company builds power pumps for mine drainage, oil pipe lines, reduction and cyanide plants, and other industrial service. The engineering tables included in Pump Data No. 50 constitute a most valuable work and one which will be of the greatest use to the mine operator or the engineer who has to do with the purchasing, installation, repair or operation of pumps. Several useful diagrams are included.

Pump Data 27 illustrates and describes selective fittings which will be found essential to pump construction or operation. These include the following: Gearing, pinions, gear guards, stairway, platforms, connecting rods, couplings, oiling systems, plungers, linings, stuffing boxes, valves and seats, shock absorbers and alleviators, check and bypass valves, relief valves, and pressure and vacuum gages.

The pumps illustrated in Pump Data No. 32 are a part of a group which have been termed "divided water-end type," so called from the fact that the working barrels and valve chambers are contained in separate castings—a divided water-end. This feature of design naturally confines the application to comparatively large quantities against lifts up to 350 ft. These pumps are suitable for general pumping requirements such as would be met at mills, mines, and quarries. The range of operation is from 350 to 1,800 gal. per minute for a maximum working lift of 100 ft., or 43 lb.; from 350 to 1,600 gal. per minute for 175 ft., or 76 lb.; from 350 to 850 gal. per minute for 350 ft., or 150 lb., and from 1,000 to 1,200 gal. for a maximum working lift of 300 ft., or 130 lb.

"Solid water-end types," those pumps in which the working barrels and valve chambers are contained in a single casting, are illustrated in Pump Data No. 34. These pumps are horizontal triplex power pumps, single-acting and with outside-packed plunger. When required, they can be mounted on trucks, which facilitates moving them about the mine. Range of operation is from 25 to 350 gal. per minute for a maximum lift of 100 ft.; 25 to 350 gal. for 175 ft., and 25 to 350 gal. for 350 ft.

Vertical quintuplex power pumps, of the so-called "pot-chamber water-end" type, are illustrated and detailed in Pump Data No. 35. In these pumps the valves are contained in separate and interchangeable pots, which feature of design makes the pumps especially applicable for handling large quantities against lifts up to and including 1,000 ft., and is suited particularly for conditions where the liquid pumped has a corrosive action on the metal because the individual pots can be replaced readily at small expense and without loss of time.

Pump Data No. 44 relate to an electric triplex sinking pump of the solid water-end type. This pump is entirely sectional—the standards, main journals, cradles, crossheads, water-end, and motor base are all separate. A special sling facilitates raising and lowering, and, when desired, the pump can be fitted with telescopic discharge, permitting raising or lowering without disconnecting and lengthening the discharge line.

The single-acting, outside-packed plunger, vertical triplex power pumps described in Pump Data 48 have a range of operation from 500 to 2,000 gal. per minute for a maximum working lift of 500 ft., or 216 lb.; from 400 to 1,600 gal. for a lift of 700 ft., or 303 lb., and 300 to 1,200 gal. for 1,000 ft., or 434 lb.

Chilled iron plungers and patented metallic packing, suitable to horizontal, vertical, power or steam pumps, are detailed in Pump Data 53.

Data that illustrate the Aldrich horizontal, higher-speed pumps, which are specially designed with extra large valves and water passages for higher pump speed with low water velocity, are given in Pump Data No. 58. The range of operation of these horizontal triplex power pumps is from 50 to 250 gal. per minute, for lifts of 100 ft. and from 50 to 250 gal. per minute for 175 ft.

Single-acting, outside-packed plunger, vertical triplex power pumps are described in Pump Data No. 60. Specifications are given for 4-in., 6-in., 7-in., 8-in., 9-in. and 10-in. stroke pumps.

In Pump Data Nos. 80 and 81 are included information concerning Aldrich "Utility" vertical triplex power pumps. These pumps have a wide range of utility, and their descriptions will no doubt be interesting to those who are familiar with the larger units.